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EVAPORATION FROM THE SALTON SEA.

By C. E. GRUNSKY,[*] M. Am. Soc. C. E.

The surface of Salton Sea, California, is 200 ft. below sea-level. The greatest depth of the water in this sea is nearly 80 ft. Its area is about 440 sq. miles. It may be accepted as a fact that there is no loss of water from the sea in appreciable amount by infiltration into the crust of the earth. Neither does the sea receive any appreciable accession to its waters from submerged springs. It lies in a basin which had a dry bed until flooded with water from the Colorado River. The accession to its waters comes in the form of rain; local run-off from adjacent areas due to occasional storms of small extent, and the discharge of Alamo and New rivers.

The rain is ordinarily only 2 to 3 ins. per year. The local run-off before there was a sea was inadequate to cover the bottom of the basin with water. It may, in its effect upon the water surface, so far as this preliminary discussion is concerned, be neglected. The discharge of Alamo and New rivers for a year past can be approximated with a fair degree of accuracy. The elevation of the surface of the sea has been recorded from day to day. It is therefore possible to reach some conclusion relating to evaporation from this large body of water, located in a region where the summer is long and warm and the relative humidity of the air is low.

TRESTLE OF THE SOUTHERN PACIFIC CO. OVER SALT CREEK, NEAR DRUMID, SALTON SEA, CAL.; MAY, 1907.

(By courtesy of the U. S. Geological Survey.)

The facts relating to the flow of Alamo and New rivers, which were used in estimating the effect of these rivers upon the stage of the sea, have been furnished by Mr. F. C. Herrmann, Chief Engineer of the California Development Co. Under his direction gagings were made of New River at Calexico, covering the period June, July, August and September, 1907. Subsequent to that time the flow in New River has been small at Calexico. To the flow of New River at Calexico, however, there is to be added the seepage from the irrigated lands, amounting, says Mr. Herrmann, to about 40 sec.-ft., as an average.

The flow in the Alamo is made up of the water wasted from the canal system at Sharps, of which Mr. Herrmann has kept careful record, of the flow in the Holton power canal, of wastage from the canals of the mutual water companies and of seepage. Concerning the wastage of water by the canal companies Mr. Herrmann states that this cannot be determined accurately, but that he believes that it will rarely exceed 25 sec.-ft. Of the seepage, he says that three times as much irrigated land is tributary to the Alamo as to the New River and that therefore seepage to the amount of 100 to 150 ft. may be expected in the Alamo. This is probably an overestimate, if intended to apply to the entire year. It appears from gagings of the Alamo, made at Brawley, March 23 to 31, 1908, and of gagings of the Holton power canal, and of the wastage at Sharps during the same time, that the excess flow at Brawley over the combined flow into the Alamo at Sharps and through the power canal averaged about 100 sec.-ft. The assumption may therefore be made that 100 sec.-ft. or 200 acre-ft. per day is the amount to be allowed for wastage from the mutual canals, together with the seepage which reaches the sea through the channel of Alamo River.

The accession of water to Salton Sea from all sources, except local run-off (which, as stated, is negligible) and rain for a year commencing with April, 1907, are given in Table I.

The elevation of the sea from month to month, based on information furnished by the Southern Pacific Co., is shown in Fig. 1. and in Table II.

Any of the individual readings, on which these elevations are based, may be in error one way or the other, a small amount, probably not exceeding 0.05 ft., due to wind ripples. Some of them may be in error, larger amounts due to the effect of strong wind in piling the water up at one end or the other of the sea. The gage on which water-surface elevation is observed is attached to a pile of the railroad trestle across Salt Creek, not far from Durmid, on the northeast shore of the sea. (See half-tone on p. 163.) Using the foregoing data, and rainfall as taken from records at stations both to the north and to the south of Salton Sea, Table III., printed on the next page, has been prepared.

The rainfall was estimated from the data from the published records of the U. S. Weather Bureau, as shown by Table IV., on the next page.

The rates of evaporation per 24 hours, as shown in the table, are plotted in Fig. 2. For comparison with the resulting irregular line representing rates of evaporation, there are platted in the same diagram the observed rates of evaporation at Kingsburgh, Cal., and the estimated rates of evaporation at Indio, Cal., located in the Salton Sink, 15 miles north of Salton Sea. Two curves are shown for the latter point: one based on evaporation results at Kingsburgh and Indio temperatures for individual months of 1907 and 1908; the other based on the normal monthly mean temperature and the rates of evaporation shown by the Kingsburgh observations for temperature as a variable, as explained further on.

It is at once seen that the observed evaporation from Salton Sea in July and August is undoubtedly less and that the observed evaporation in November and December is greater than what actually took place. The discrepancy between the evaporation rates for single months, as determined from temperatures at Indio and those deduced from the water elevation of the sea, is probably mainly due to wind effect upon the water elevation at the Salt Creek gage. It seems probable that the gage readings at that point show elevations that are too low by 0.2 to 0.3 ft. for June 1 and July 1, 1907, and elevations that are about 0.5 to 0.4 ft. too high on Sept. 1, Oct. 1 and Nov. 1, and 0.1 to 0.2 ft. too high on Dec. 1.

By assuming that wind or some other cause is accountable for the larger part of the inconsistencies in the observed monthly rate of evaporation at Salton Sea, and smoothing out the rate curve based on observation, as shown in Fig. 2, it is possible to predict, from the single year's record, probable rates of evaporation from Salton Sea. The smoothed-out curve, as shown in Fig. 2, is in some measure made to conform in general shape to the other evaporation curves shown in the same figure. Using the smoothed-out curve as an index the rates of evaporation from Salton Sea given in Table V. appear probable:

These rates indicated by the curve are equivalent to 6.12 ft. per year, which is, as a matter of course, in substantial accord with the evaporation determined from the decreasing elevation of Salton Sea, above noted, at 6.14 ft. for the 12 months April 1, 1907, to April 1, 1908.

It is known, however, that the temperature for these 12 months was 0.4° below the normal temperature at Indio and 2.9° below the normal at Mammoth Tank, southeast of Salton Sea; therefore without doubt to some extent below normal at Salton Sea. If, therefore, it were desired to approximate more closely the probable evaporation from Salton Sea a temperature correction could be applied the basis for which can readily be found in the published records of temperature and the experimental data subsequently noted.

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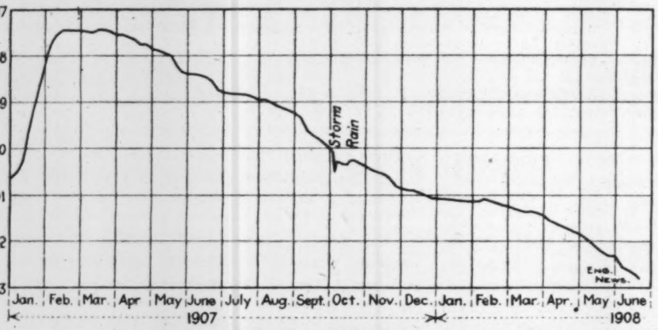

FIG. 1. ELEVATIONS OF WATER SURFACE IN SALTON SEA, CAL. (From records of the Southern Pacific Co.)

In the years 1881 to 1885 evaporation observations were made at Kingsburgh, Cal. These observations were in charge of the writer and were made under the direction of Mr. Wm. Ham. Hall, then State Engineer of California. The results of the observations are published in Physical Data and Statistics for California, 1886. Two pans were used, one floated in the river, the other for a time (the first three months) on a bridge, later on the ground, with sand banked around its sides to the height of the water surface. The pans were 3 ft. sq., about 15 ins. deep and the water surface was kept at about 5 ins. below the tops of the sides. They were constructed of galvanized iron, a peg tapering to a point rose in the center of each pan to the water surface.

The observer was required to replenish the evaporated water from time to time, using a gaged vessel, the contents of which represented 0.01-ft. of water depth. Observations of temperature were made daily. The water was replenished daily in the warm months and in winter, whenever it had fallen about ¼-in. below the top of the peg. It was always replenished when the weather was threatening. After a rain storm the excess water was dipped out, a record of the water taken out being made.

TABLE I.—ACCESSION OF WATER TO SALTON SEA, IN ACRE-FEET, YEAR ENDING MARCH, 1908.

(Figures in Parenthesis are estimated.)

	New River.		Alamo River.			
1907.	At Calexico.	Seepage.	At Sharps.	Holton Canal.	Seepage and wastage.	Total.
April	(5,000)	(2,400)	18,250	650	(6,000)	32,300
May	(15,000)	(2,480)	8,950	1,260	(6,200)	33,890
June	73,470	(2,400)	11,380	1,890	(6,000)	95,140
July	108,160	(2,480)	33,380	2,150	(6,200)	152,370
August	27,539	(2,480)	25,430	2,120	(6,200)	63,769
Sept.	13,597	(2,400)	11,770	2,100	(6,000)	35,867
Oct.	8,720	(2,480)	7,660	2,140	(6,200)	27,200
Nov.	(4,000)	(2,400)	6,950	2,180	(6,000)	21,530
Dec.	(2,000)	(2,480)	14,420	2,480	(6,200)	27,580
1908.						
Jan.	(1,000)	(2,480)	12,020	1,840	(6,200)	23,540
Feb.	(1,000)	(2,320)	5,800	1,090	(5,800)	16,010
March	(1,000)	(2,480)	1,500	2,560	(6,200)	13,740

TABLE II.—ELEVATIONS OF SALTON SEA AT THE BEGINNING OF EACH CALENDAR MONTH, JANUARY, 1907, TO APRIL, 1908.

	Feet below sea level.		Feet below sea level.
Jan. 1, 1907	200.65	Sept. 1, 1907	199.25
Feb. 1, 1907	198.15	Oct. 1, 1907	200.05
March 1, 1907	197.45	Nov. 1, 1907	200.40
April 1, 1907	197.50	Dec. 1, 1907	200.85
May 1, 1907	197.82	Jan. 1, 1908	201.10
June 1, 1907	198.40	Feb. 1, 1908	201.15
July 1, 1907	198.80	March 1, 1908	201.25
August 1, 1907	198.95	April 1, 1908	201.45

TABLE III.—FALL OF WATER SURFACE, INFLOW, RAINFALL AND EVAPORATION AT SALTON SEA, 1907-8.

		Inflow.			Evaporation, ft.	
1907.	Fall of water surface, ft.	Acre-ft.	Effect upon elev. of sea, ft.	Rain, ft.	Amt.	Rate per 24 hrs.
April	0.32	32,300	0.11	0	0.43	.0143
May	0.58	33,890	0.12	0.01	0.71	.0230
June	0.40	95,140	0.34	0	0.74	.0247
July	0.15	152,370	0.54	0	0.69	.0223
Aug.	0.30	63,769	0.23	0	0.53	.0171
Sept.	0.80	35,867	0.13	0	0.93	.0310
Oct.	0.35	27,200	0.10	0.12	0.57	.0184
Nov.	0.45	21,530	0.08	0.01	0.54	.0180
Dec.	0.25	27,580	0.10	0	0.35	.0113
1908.						
Jan.	0.05	23,540	0.08	0.05	0.18	.0058
Feb.	0.10	16,010	0.06	0.06	0.22	.0078
March	0.20	13,740	0.05	0	0.25	.0081
12 months	3.95		1.94	0.25	6.14	

The purpose of the Kingsburgh observations was not to establish any law of evaporation but to ascertain the probable annual total from a water surface. The four-year record at that point showed 3.85 ft. as the depth of water evaporating annually from the pan floated in the river, and 4.96 ft. as the depth of water evaporating from the pan on the ground.

It is believed that the evaporation measured from the pan floating in the river at Kingsburgh was somewhat less than would have occurred from a large body of open water, mainly for the reason that some protection was afforded to the pan by high river banks, a fringe of low trees and a nearby bridge, and for the further reason that the river temperature was probably a little below what would have been the temperature of an open body of water. But the pan on the ground probably showed evaporation in excess of what would have taken place from a large water surface, particularly for the reason that the water in this pan was warmer than the water surface of any large water body would have been. It is believed proper to introduce the measured values into a calculation by giving those of the pan in the river triple weight, and combining the two sets. The result may be accepted for the present as the probable evaporation from a water surface in the central portion of the San Joaquin Valley.

The observations at Kingsburgh gave results which are shown in Table VI.

TABLE IV.—RAINFALL SOUTH AND NORTH OF AND AT SALTON SEA, 1907-8.

	Rain in inches				Rain on Salton Sea.	
	South of Salton Sea.		North of Salton Sea.			
Month.	Heber.	Imperial.	Indio.	Mecca.	Inches.	Feet.
Jan. 1907.	0.11	0.25	0.59	0.33	[illegible]	0.03
Feb.	0.19	0.40	0.63	0.34	[illegible]	0.03
Mar.	0.46	....	0.96	1.25	[illegible]	0.06
Apr.	0	....	0	0	[illegible]	0
May	0.14	....	0.05	0	[illegible]	0.01
June	0	....	0	0	[illegible]	0
July	T	....	0	0	[illegible]	0
Aug.	0.10	....	0	0	[illegible]	0
Sept.	0	....	0	0	[illegible]	[illegible]
Oct.	1.14	....	1.60	1.95	[illegible]	0.12
Nov.	....	....	0.05	0.05	[illegible]	0.01
Dec.	0	....	T	0	[illegible]	0
Jan., 1908.	0.30	0.22	0.95	....	[illegible]	0.05
Feb.	0.75	....	0.57	....	[illegible]	0.06
Mar.	....	0.01	0.01	....	[illegible]	0
Apr.	T	0.03	0	....	[illegible]	0

TABLE V.—PROBABLE RATES OF EVAPORATION FROM SALTON SEA BY MONTHS.

	Ft. in 24 hrs.		Ft. in 24 hrs.		Ft. in 24 hrs.
Jan.	.0060	May	.0188	Sept.	.0261
Feb.	.0065	June	.0250	Oct.	.0174
Mar.	.0090	July	.0303	Nov.	.0102
Apr.	.0132	Aug.	.0308	Dec.	.0070

TABLE VI.—EVAPORATION AT KINGSBURGH, CAL.

(Evaporation records Nov., 1881, to Oct., 1885. Temperature based on U. S. Weather Bureau records, 1888 to 1902.)

	Fresno	Kingsburgh Evaporation in feet per 24 hours.		
	Mean monthly temp.	Pan in river. Wgt. 3.	Pan on the ground. Wgt. 1.	Open water. (Probable.)
Jan.	45.3	.0021	.0026	.0022
Feb.	50.2	.0036	.0033	.0035
March	54.4	.0066	.0073	.0068
April	60.8	.0071	.0095	.0077
May	67.4	.0091	.0178	.0113
June	74.1	.0161	.0259	.0185
July	82.1	.0203	.0292	.0225
Aug.	81.0	.0233	.0278	.0244
Sept.	73.8	.0180	.0205	.0186
Oct.	64.2	.0109	.0093	.0096
Nov.	54.6	.0059	.0058	.0059
Dec.	47.0	.0032	.0034	.0032

The formulas that have heretofore been recommended for determining evaporation are based on Dalton's law, which is in the form:

$$E = C\,(e_w - e_d)\,(1 + A\,v)$$

where C is a constant, e_w is the vapor pressure at the temperature of the water, e_d is the vapor pressure at the dew-point temperature, A is a wind constant and v is the velocity of the wind. A number of values have been determined for C and A, but they lack agreement. (See Monthly Weather Review for July, 1907.)

There is a new formula now under consideration, suggested by Prof. F. H. Bigelow, of the U. S. Weather Bureau (Monthly Weather Review for Feb., 1908) which has the form,

$$E = C\,f\,(h)\,e_d\,\frac{d\,e}{d\,s}\,(1 + A\,v),$$

where $C\,f\,(h)$ is a variable, a function of the height of a water pan above the ground, e_d is the vapor pressure corresponding with the dew-point of the air, $d\,e/d\,s$ is the rate of change of the vapor pressure with the change of the temperature of the water at the surface, A is a wind constant, and v is the wind velocity.

No formula in either of the above forms will meet the ordinary requirement of the engineer who is frequently called upon to determine from known weather conditions, usually temperature, humidity and rainfall records, frequently temperature and rainfall only, the amount of evaporation from a body of water not yet in existence. To make use of the ordinary formulas for evaporation, there is requisite, among other basic facts, a knowledge of the water temperature, practically from hour to hour, and this obviously is in most cases as much an unknown fact as the rate of evaporation itself. Perhaps, therefore, it may be allowable to compare the rate of evaporation during a moderately long time unit, as for a month, directly with the mean temperature of the air for the same time and to apply the relation thus established between tem-

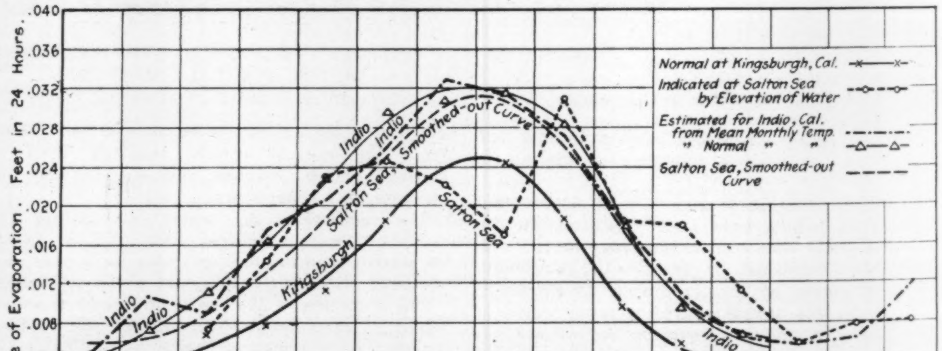

FIG. 2. MONTHLY RATES OF EVAPORATION AT KINGSBURGH, SALTON SEA AND INDIO, CAL.

TABLE VIII.—TEMPERATURES AT KINGSBURGH AND INDIO, CAL., 1881 TO 1885.*
(Authority, Central Pacific R. R. Co.)

Month.	1881 Max.	1881 Min.	1881 Mean.	1882 Max.	1882 Min.	1882 Mean.	1883 Max.	1883 Min.	1883 Mean.	1884 Max.	1884 Min.	1884 Mean.	1885 Max.	1885 Min.	1885 Mean.
Temperature at Kingsburgh, Cal.															
Jan.	70	30	49.2	62	10	41.7	76	16	41.1	82	33	56.2	79	30	51.7
Feb.	68	42	53.4	70	31	48.2	83	25	46.8	90	32	53.5	90	32	56.8
March	84	33	54.7	89	34	57.4	89	40	60.5	90	39	56.4	82	42	59.4
April	89	45	64.6	95	46	59.4	105	36	61.8	90	43	61.7	87	45	61.5
May	92	50	71.5	106	46	75.3	108	38	68.6	98	50	71.5	102	54	71.5
June	105	57	75.4	106	55	79.8	105	66	84.2	95	61	75.8	99	56	73.4
July	107	60	84.9	110	71	87.7	105	68	86.8	105	65	83.6	105	64	81.5
Aug.	105	55	83.1	110	68	88.8	112	61	84.0	106	60	84.7	111	62	84.5
Sept.	104	45	74.4	107	49	77.8	103	65	79.8	100	52	72.2	104	57	77.9
Oct.	70	30	60.6	86	46	63.3	87	45	67.6	80	48	66.0	96	44	65.6
Nov.	75	28	48.7	80	30	49.6	79	44	61.3	82	46	60.8	70	30	54.1
Dec.	68	32	48.0	74	28	47.4	85	31	57.9	..	..	....	..	..	....
Year	107	28	64.0	110	10	64.7	112	16	66.7	106	..	62.4	111	..	65.5
Temperature at Indio, Cal.															
Jan.	79	36	52.5	78	30	47.2	80	19	46.2	78	32	52.3	83	32	52.3
Feb.	90	32	64.6	77	30	54.4	87	31	56.4	88	32	56.4	87	40	61.5
March	100	32	68.2	94	30	65.3	87	53	67.9	81	49	61.7	94	40	64.1
April	105	60	77.6	104	58	72.7	98	49	70.8	96	51	68.0	98	56	73.4
May	104	70	82.8	101	70	81.4	111	53	78.6	103	60	76.0	106	66	83.6
June	108	70	89.8	108	70	87.2	116	72	82.8	106	65	82.5	104	66	83.0
July	113	85	97.1	117	82	95.1	110	75	94.1	112	82	93.2	108	72	92.7
Aug.	113	87	93.8	112	82	92.9	114	70	91.1	112	74	91.7	114	76	94.7
Sept.	110	70	86.1	108	57	84.7	114	63	86.8	104	58	82.1	108	62	88.6
Oct.	98	51	73.1	98	50	74.5	98	47	74.6	97	52	74.6	104	54	79.2
Nov.	85	32	57.9	89	35	61.5	96	34	63.8	91	41	62.6	90	35	64.3
Dec.	82	30	58.9	89	42	59.6	90	40	60.9	88	28	61.9	..	..	....
Year	113	30	75.2	117	30	73.0	116	19	72.9	112	28	71.9	114	..	75.0

*From Physical Data and Statistics, California State Engineer, Wm. Ham. Hall, 1886.

TABLE IX.—TEMPERATURE, RAINFALL AND HUMIDITY, FRESNO, CAL., AND YUMA, ARIZ.

	Fresno, Cal.				Yuma, Ariz.			
			Relative humidity.				Relative humidity.	
	Temp., F.	Rain, ins.	8 a. m.	8 p. m.	Temp., F.	Rain, ins.	8 a. m.	8 p m.
January	45	1.6	91	71	54	0.4	55	45
February	51	1.3	89	57	59	0.5	57	41
March	54	1.5	86	49	64	0.3	58	34
April	60	0.6	81	34	70	0.1	53	25
May	67	0.5	74	27	77	T	55	26
June	75	0.1	59	19	85	T	55	24
July	82	T	50	14	92	0.1	61	35
August	81	T	54	16	91	0.3	65	40
September	74	0.3	62	22	84	0.1	62	36
October	64	0.6	75	37	73	0.2	59	39
November	55	1.1	76	47	62	0.3	53	42
December	46	1.6	91	70	56	0.4	54	48
Year	63	9.2	74	39	72	2.7	57	36

Note: Fresno is about 20 miles northwest of Kingsburgh. Both Fresno and Kingsburgh are on the same vast San Joaquin Valley plain, practically on a line parallel with the axis of the valley, which here has a width of over 50 miles.

perature and evaporation to regions that are known to have climates similar to those at which evaporation measurements have been made.

Such a comparison, with complete disregard of water temperature and of wind movement, is justified because the water temperature of large open bodies of water will, in some measure, fluctuate with the long period (monthly) mean temperature of the air, and the wind effect, on the assumption of similar climatic conditions, will not be so greatly at variance in the long run as to materially invalidate the conclusions.

Taking this view, and making the attempt to find a method for approximating the daily rate of evaporation when the mean temperature of the air by months is known, the diagram, Fig. 3, has been prepared. Curves are shown based on the Kingsburgh records, on the 6 years of observation (between 1876 and 1886) at the Chestnut Hill Reservoir, Boston, as reported by Mr. Desmond Fitzgerald to the American Society of Civil Engineers, in 1886, and on a 14-year series (1860-1873) of evaporation observations, at the Lee Bridge, near Greenwich, England, by Mr. Chas. Greaves, C. E. (Proc. Inst. C. E., Vol. xlv.).

The evaporation records for the Chestnut Hill Reservoir, Boston, water-works, and for the pan floating in water at Lee Bridge, England, are shown in condensed form in Table VII.

The Boston curve follows closely the evaporation rates as determined from Mr. Fitzgerald's smoothed-out curve of monthly evaporation depth. These rates differ somewhat from the observed and approximated values for the individual months. (The evaporation rates during the winter months, in which observations were not continuous, at Chestnut Hill are based on estimates by Mr. FitzGerald.) Both sets of monthly evaporation rates are shown in the diagram. It will be noted in the case of the observations made by Mr. Greaves, and also in the case of the observed values for Chestnut Hill Reservoir, that there must have been some peculiarities of wind movement, or of water temperature, or of temperature fluctuations, or of humidity of the air, or other climatic conditions, that bring the observed points for the months in the first half of the calendar year, particularly March to June, considerably above, and for the months later in the year, notably August to November, in like measure below the curves representing mean values. A much more satisfactory agreement exists between the observed values for the several months at Kingsburgh and the means indicated by the resulting curve.

Is it not possible that in certain climates, as at Boston and at Lee Bridge, England, evaporation takes place more rapidly when the air temperature is rising from day to day, as in the spring months, than when the temperature is falling? If this be the case it may be tentatively suggested that as a second approximation the evaporation rates determined from monthly mean temperature of the air may be corrected by adding the following:

$$q = C\,(\Delta\,t),$$

where q is the quantity to be added, $\Delta\,t$ is the temperature change (30-day means only being considered) that takes place during the month and C is a constant to be determined for each locality under consideration. $\Delta\,t$ will be positive during the rising temperatures of the spring months and negative during the falling temperatures of the autumn months. For Boston (temperature in degrees F. and evaporation in ft. per 24 hours) the value of C is about .0002; for Lee Bridge, England, about .0003, and for Kingsburgh, zero.

However, as a rule, the engineer deals only with the total evaporation in a year, and is rarely concerned with its correct distribution to the individual months.

The wide divergence of the Boston curve from the curves based on the Lee Bridge and on the Kingsburgh records must for the present be attributed to general climatic conditions other than mean monthly temperature. The daily, temperature range may be suggested as one among other possible disturbing factors.

The Kingsburgh curve, as platted on the diagram, may serve for approximating evaporation rates for points in the West and in the Southwest. The Boston curve should give better results for the Atlantic Coast and probably the Middle West.

The similarity of climates at Kingsburgh and at the Salton Sea will appear from the comparisons of temperature and rainfall, shown in Table VIII. Indio, selected as representative of the Salton Sea region, lies a short distance northwesterly from Salton Sea, in the Salton Basin, at an elevation about 20 ft. below sea.

During the period covered by the Kingsburgh evaporation record, the rainfall at Kingsburgh and at Indio, in inches, was as follows:

	1881-2	1882-3	1883-4	1884-5
Kingsburgh	4.74	5.75	15.85	7.50*
Indio	1.55	3.04	5.62	0.80

*Approximate.

Yuma, Ariz., may also be cited as a point with a climate similar to that of the Salton Basin. Yuma being the nearest station of the U. S. Weather Bureau to Salton Sea the comparison shown by Table IX. has been made between temperature, rainfall and humidity records at Yuma and Fresno. The temperature and rainfall records at Yuma cover 28 years, the humidity records 15 years. The data for Fresno (which has a climate practically identical with Kingsburgh) are based on records covering a 15-year period.

Expressed in tabular form the relation of the rate of evaporation to the mean monthly temperature for climatic conditions similar to those at Kingsburgh, Cal. (indicated by records at Fresno the nearest U. S. Weather Bureau station), may be noted as in Table X.

TABLE X.—MONTHLY TEMPERATURES AND CORRESPONDING RATES OF EVAPORATION IN 24 HOURS.

Mean monthly temp., F.	Corresponding rate of evaporation, ft. in 24 hrs.	Mean monthly temp., F.	Corresponding rate of evaporation, ft. in 24 hrs.
35°	.0010	65°	.0109
40°	.0016	70°	.0147
45°	.0025	75°	.0187
50°.	.0038	80°	.0228
55°	.0055	85°	.0270
60°	.0078	90°	.0312

By use of these evaporation rates, indicated by the Kingsburgh evaporation curve, the determination of probable evaporation at Indio, which may for the present be accepted as applicable to Salton Sea, has been made (Table XI.).

According to this estimate the evaporation from Salton Sea from April 1, 1907, to April 1, 1908, should have been 6.54 ft., and the normal annual evaporation should be 6.70 ft. If later observations show that the sea has had an appreciable effect upon temperature then even the

TABLE VII.—EVAPORATION RECORDS AT CHESTNUT HILL RESERVOIR, BOSTON WATER-WORKS, AND LEE BRIDGE, ENGLAND.

	Boston.*				Chestnut Hill Res. Evaporation, ins.		Lee Bridge, England.	
			Relative humidity %					
Month.	Temp., F.	Rain, ins.	8 a. m. %	8 p. m. %	Observed or approximated.	From smoothed-out curve.	Temp., F.	Evaporation, ins.
Jan.	27	3.9	73	70	0.90	0.98	38.5	0.761
Feb.	28	3.6	73	70	1.20	1.01	40.8	0.603
March	35	4.3	71	69	1.80	1.45	42.5	1.065
April	45	3.5	67	66	3.10	2.39	48.1	2.098
May	57	3.4	70	68	4.61	3.82	54.2	2.753
June	66	2.9	72	71	5.86	5.34	60.2	3.142
July	72	3.4	71	72	6.28	6.21	6.40	3.443
Aug.	70	4.2	76	75	5.49	5.97	63.3	2.849
Sept.	63	3.0	77	76	4.09	4.86	58.4	1.606
Oct.	53	3.9	77	73	2.95	3.47	50.6	1.056
Nov.	42	4.2	77	73	1.63	2.24	43.9	0.707
Dec.	32	3.4	74	70	1.20	1.38	39.5	0.622
Year	49	43.7	73	71	39.11	39.12	50.3	20.705

*From U. S. Weather Bureau records: Temp. and Rain, 1873 to 1903, and Relative Humidity, 1889 to 1903.

small discrepancy between the value, 6.54 ft., estimated, and 6.14 ft., heretofore noted as observed, may disappear. In this event, a suitable factor for temperature reduction resulting from the creation of a new body of water may have to be introduced.

It may be that a closer approximation to actual evaporation from a large water surface could have been made by giving the results of observations in the pan floating in the river at Kingsburgh still greater weight than herein above noted.

Special evaporation studies are about to be made in the Salton Basin by the U. S. Weather Bureau, under cooperation of the U. S. Geological Survey and the U. S. Reclamation Service. These will, it is expected, determine with precision the actual evaporation by months and years from the Salton Sea. The direct observations to accomplish this should include, at least three times per month, simultaneous water-surface observations at opposite ends of the sea. But the information sought that will be of greatest value to the engineer will be the relation that the evaporation thus ascertained from a large open water-surface bears to experimental observations, made with small pans, placed upon the open ground, with no more protection against sun and wind than will result from sinking the pans into the ground to such depth that their water-surfaces will conform to the ground level. Incidentally, the great range of temperature, the dryness of the air, the insignificant rainfall and the small easily measured inflow into the Salton Sea should make the Salton Basin studies extremely valuable in determining the best formulas for estimating evaporation from known meteorological conditions.

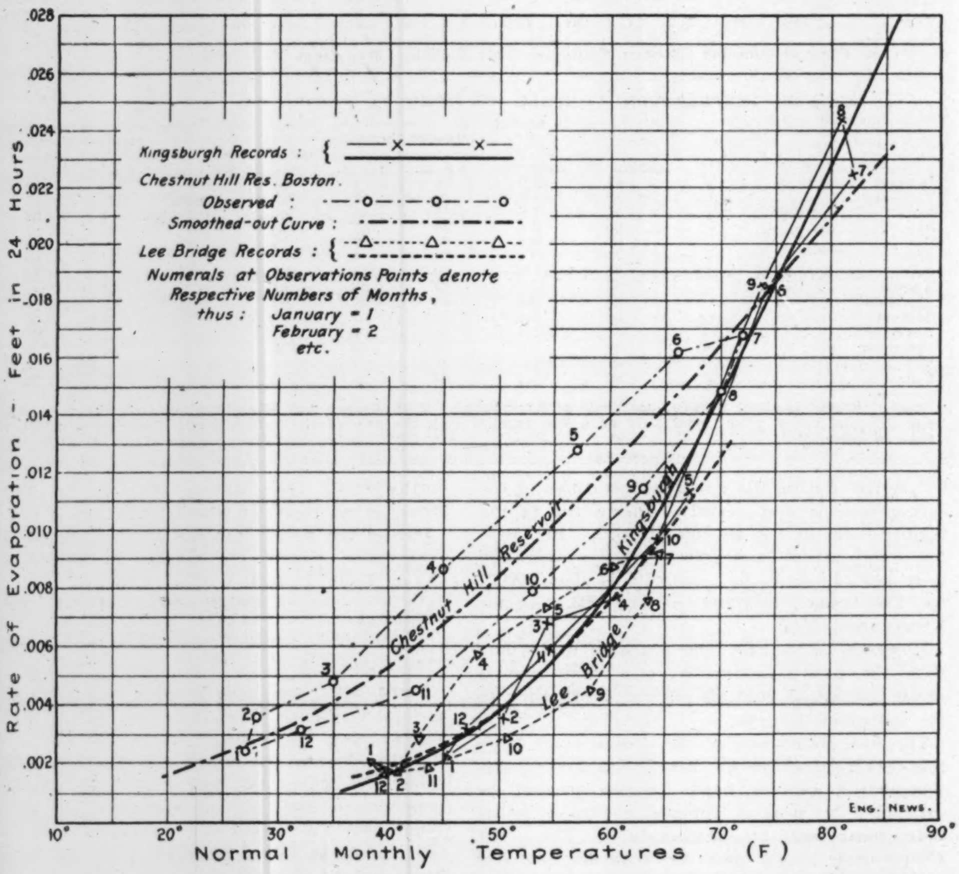

FIG. 3. EVAPORATION FROM A WATER SURFACE IN ITS RELATION TO THE TEMPERATURE OF THE AIR.

TABLE XI.—EVAPORATION AT INDIO. (From Open Water.)

1907-8.

Month.	Temp., F.	Estimated evap., ft. Rate per day.	Estimated evap., ft. Amount per month.
Jan., 07	52.7	.0046	.14
Feb.	64.5	.0106	.30
March	62.0	.0090	.28
April	73.8	.0176	.53
May	77.4	.0205	.64
June	83.8	.0259	.78
July	92.0	.0329	1.02
Aug.	90.3	.0314	.97
Sept.	85.2	.0271	.81
Oct.	74.5	.0182	.56
Nov.	64.8	.0108	.32
Dec.	57.0	.0063	.20
Jan., 08	55.4	.0056	.17
Feb.	56.7	.0062	.18
March	66.2	.0118	.36

Normal year.

Month.	Temp., F.	Estimated evap., ft. Rate per day.	Estimated evap., ft. Amount per month.
Jan.	52.9	.0047	.15
Feb.	58.7	.0072	.20
March	65.3	.0112	.35
April	72.5	.0166	.50
May	80.1	.0228	.71
June	88.3	.0297	.89
July	89.5	.0308	.95
Aug.	93.0	.0337	1.04
Sept.	86.5	.0282	.85
Oct.	75.4	.0190	.59
Nov.	62.6	.0094	.28
Dec.	56.6	.0062	.19
Year			6.70

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EXPERIMENTAL ELECTRICAL TREATMENT OF WATER TO REMOVE INCRUSTATING SOLIDS.[*]

By J. L. CAMPBELL, M. Am. Soc. C. E.[†]

The water supply of the El Paso & Southwestern Ry. at Alamogordo, N. M., is secured by gravity from the town of Alamogordo, which brings the water down from the Sacramento Mountains by gravity through a pipe line. For treatment in the electrical plant this water is delivered to the receiving tank direct from the city pressure and is pumped from the settling basin after treatment through a Jewell filter to the railway service tank.

The results of the treatment are quite satisfactory, except in the matter of cost. The incrusting properties of the untreated water are very materially reduced, without adding to its foaming propensities, as in the case of treatment by soda ash or caustic soda. The Alamogordo water, however, can be very economically softened by the use of lime, without the addition of soda ash. Up to the present time, the electrical power supplying the current has been purchased at the rate of ¾ ct. per HP. hour, but in the future this will cost 1½ cts. This will add 7½ cts. per 1,000 gallons treated to the present cost of 47.9 cts. There are economies which we could introduce in the permanent operation of the t, which would probably more than offset the incr cost of power. Apparently, however, it would n safe to assume, at the present time, that we cou duce the cost much below 45 cts. per 1,000 gallons.

For the exceptionally bad waters of the nal supply on the division between Carrizozo and ta Rosa, which are now eliminated by a pipe line ply, the successful treatment by electricity would twice as much as the treatment at Alamogordo. In we have not yet successfully demonstrated that wat ontaining as high as 100 to 150 grains of incrustatin d foaming solids can be successfully treated by e icity, although the indications are that it would b acticable to secure results as good as those obtained the lime and soda ash treatment, but at a greatly in ed cost.

From the financial standpoint it does no ppear at present that we can afford to continue th lectrical treatment in competition with lime and so ash, although the results obtained by electricity on ter that contains a large amount of foaming solid ould be very much better than with lime and soda h. The tabulated statement herewith and the specific data relative to the plant have been prepared by M H. W. Cutshall, our Superintendent of Electrical I tallation and Operation.

REPORT ON ALAMOGORDO ELECTRIC WATER TREATING PLANT (March 6, 1908.)

With the attached tabulated statement bas on the January (1908) run for 29 days in the tr ment of water at Alamogordo, several features have developed which will be briefly mentioned in this report.

The plant (shown in the accompanying cut) consists of three parallel tanks, 79 ft. 3½ ins. in length and 5 ft. 2 ins. in width, subdivided into 25 vats. Each vat is 5 ft. 2 ins. long, 36½ ins. wide and 3 ft. 5½ ins. deep. The tanks and vats are constructed of clear yellow-pine matched lumber. The sides of each vat are provided

DESCRIPTION OF ELECTRIC TREATING PLANT.

No. of tanks	3
No. of vats	75
Capacity of each tank	7,200 gals.
Steel plates, gage and size	No. 14, 36 × 36 ins.
Steel plates, number	4,500
No. of plates per tank	1,500
No. of plates per vat	60
Total weight of plates	125,370 lbs.
Weight of single plate	27.84 lbs.
Direct-current voltage	115
MONTH'S RUN.	
Amount treated	1,562,400 gals.
No. tanks treated in 29 days	217
Total electric HP.-hours	15,650
Total consumption of plates	9,360 lbs.
Loss on single plate	2.08 lbs.
RUN PER 1,000 GALLONS.	
Electric HP. hours 1,000 gals	10 HP.
Loss of iron per 1,000 gals	6.63 lbs.
Average time of treatment	4.5 hours
Voltage at start	115
Amperes at start	230
Amperes after 4.5 hours	195
Average voltage	112
Gallons treated in test	14,400
COST PER 1,000 GALLONS TREATED.	
Electric power	$0.075
Labor	.108
Fuel	.018
Plates actually consumed	.212
Loss by unserviceable part of plate left at end of ten months	.066
Cost of treatment per 1,000 gallons	$0.479

ANALYSIS OF UNTREATED WATER FROM ALAMOGORDO PLANT (Grains per U. S. Gallon.)

Analysis.		Probably Combined.	
Silica	.700	Silica	.700
Oxides of iron and aluminum	.233	Oxides of iron and aluminum	.233
Calcium oxide	7.725	Sodium chloride	2.112
Magnesium oxide	2.625	Sodium sulphate	1.235
Sodium oxide	1.660	Calcium sulphate	12.248
Sulphuric acid (SO_3)	7.900	Calcium carbonate	4.790
Chlorine (Cl)	1.280	Magnesium carbonate	5.512
Carbonic acid (CO_2)	4.995		
	27.118		26.830
Less oxygen equiv. Cl	.288		
	26.830		
Volatile and organic matter	.863		.863
Total solids	27.603		27.693

Total incrusting solids 23.483 equal to 3.347 lbs. per 1,000 gallons.

Total non-incrusting solids 3.347.

ANALYSIS OF TREATED WATER. (Grains per U. S. Gallon.)

Analysis.		Probably Combined	
Silica	Trace	Silica	Trace
Oxide of iron and aluminum	Trace	Oxide of iron and aluminum	Trace
Calcium oxide	2,915	Sodium chloride	1.731
Magnesium oxide	.210	Sodium sulphate	1.579
Sodium oxide	1,608	Calcium sulphate	6.818
Sulphuric acid (SO_3)	4,900	Calcium carbonate	.193
Chlorine (Cl.)	1,049	Magnesium carbonate	.441
Carbonic acid (CO_2)	.316		
	10.998		10.762
Less oxygen equiv. Cl.	.236		
Total solids	10,762		

Total incrusting solids 7.452 equal to 1.065 lbs. per 1,000 gallons.

Total non-incrusting solids, 3.310.

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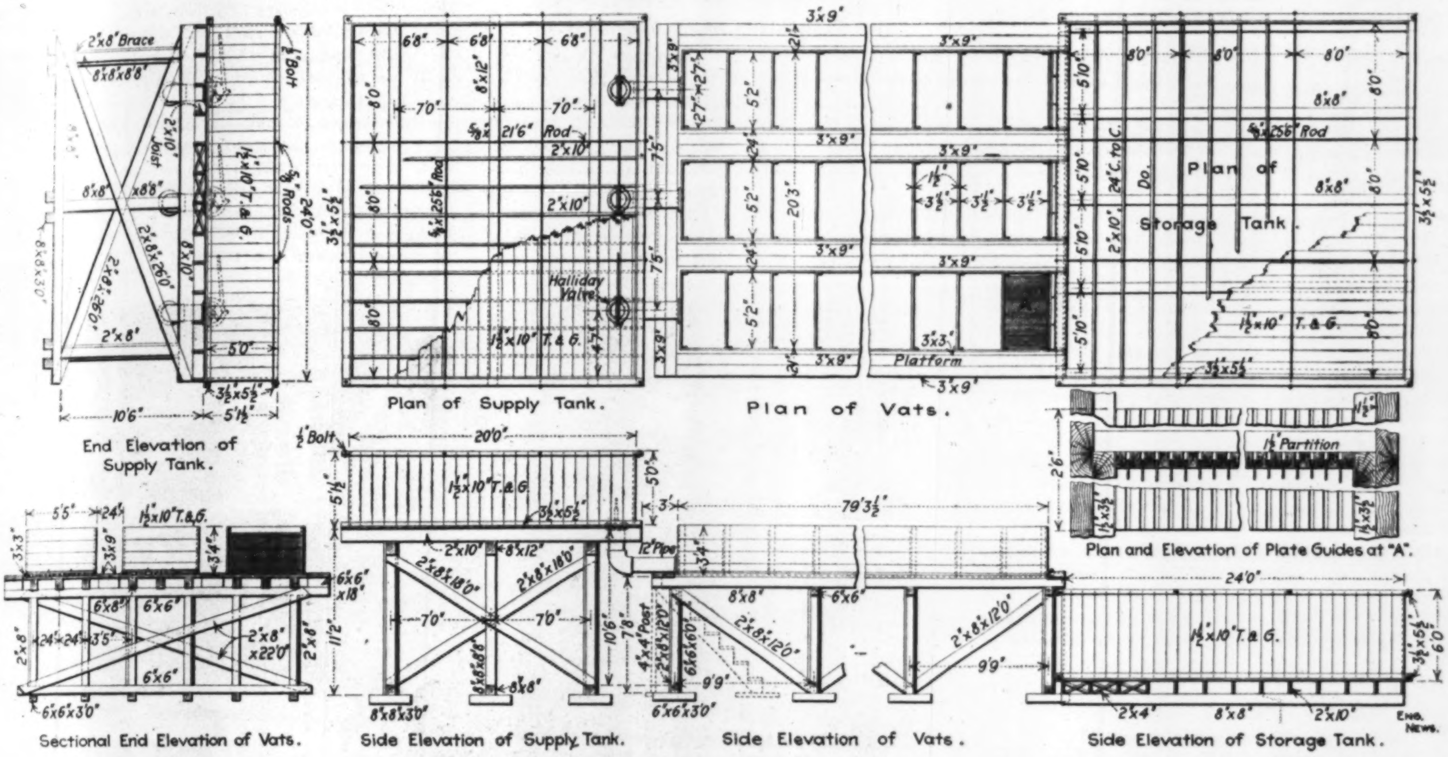
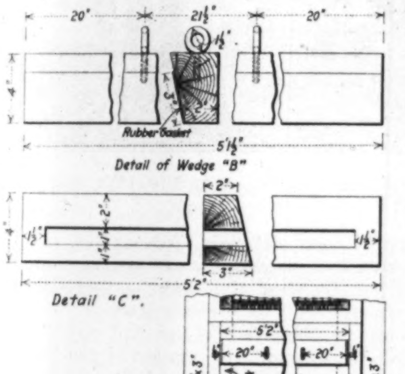
[*] From Bulletin No. 99 (May, 1908), of the American Railway Engineering and Maintenance-of-Way Association, 962 Monadnock Block, Chicago.

[†] Engineer of Maintenance-of-Way, El Paso & Southwestern Ry, El Paso, Tex.

with horizontal strips ¾ in. × 1 in., spaced 1 in. c. to c. This leaves ¼-in. slots between the strips, allowing the insertion of 60 steel plates No. 14 gage, 36 × 36 ins. These plates are provided with copper connecting strips attached to the top and 12 ins. from the side, each plate being so placed that the copper strips alternate, leaving a space of 12 ins. between them. These copper strips are connected by rods ¼-in. diameter, 5 ft. 6 ins. long, fitted with sleeves of ⅜-in. copper tubing. They are spaced approximately 2 ins. apart and secured by wing nuts at each end of the rod, which allow the fastening of the electrical conductors as well as clamp the plate connecting strips. This arrangement makes two connecting rods to each tank of 60 plates, making 30 plates to each rod.



End Elevation of Supply Tank. Plan of Supply Tank. Plan of Vats. Plan of Storage Tank. Plan and Elevation of Plate Guides at "A". Sectional End Elevation of Vats. Side Elevation of Supply Tank. Side Elevation of Vats. Side Elevation of Storage Tank.



Detail of Wedge "B". Detail "C". Longitudinal Section. Elevation.

Sluice Box Details.
(Enlarged)

A PLANT FOR THE ELECTRICAL TREATMENT OR SOFTENING OF WATER FOR LOCOMOTIVES: EL PASO & SOUTHWESTERN RY.

J. L. Campbell, M. Am. Soc. C. E., Engineer of Maintenance-of-Way.

In arranging for the electrical connection, four sets of plates in four consecutive vats are connected in multiple, and these four are then connected in series with the two adjacent tanks on either side. In operation, the two tanks of 25 vats each containing a total of 3.000 steel plates are connected electrically, so that the positive current passes through one tank, the water forming the passage for the electric current between the series-connected plates and vats, thus allowing the positive current to pass in at one end of the tanks and the negative current at one end of the other tank, the current becoming neutralized near the junction of the two tanks.

Switches for controlling the electric current are so arranged that any two of the tanks may be used together while the third one is emptying. The total capacity of each tank is 7,200 gals., allowing 14,400 gals. to be treated at one time. The voltage used is 110 or 115, direct current.

The electrical action on the plates is most marked upon the positive, which after a short time becomes bright, as if polished. Upon the negative plates a sort of slime or sludge is collected; this is caused by the chemical properties combining with what little organic matter may be found in the water. All of the heavier matter drops to the floor of the tank. A great amount of matter remains suspended in the water, which afterward settles in a large settling tank provided for that purpose.

During the process of treatment it is found that the consumption of the plates is greater where the current passes between the series connections of the plates, and where the sediment dropping to the bottom of the tank rests high enough to form a partial electrical connection between the plates. The benefit derived from electrical treatment lies in the fact that when the current passes from the plates through the water, hydrate of iron is liberated. This causes a precipitation of all incrustating solids contained in the water.

From the chemical analysis it is found that calcium carbonate, calcium sulphate, magnesium sulphate and silica are all reduced very much.

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TESTS ON BONDING NEW CONCRETE TO OLD.

By RAYMOND B. PERRY.*

In Engineering News of Dec. 12, 1907, p. 646, were reported some tests on the efficiency of various bonding methods in joining new concrete to old, tests which were first published in "Annales des Ponts et Chaussees," the third part of v. 27, 1907. With these tests as a basis, the writer has recently carried on some experiments along the same line, as a thesis presented for the degree of civil engineer to the Case School of Applied Science. In the present tests the general method of making test pieces for the tests above referred to was followed, although certain changes were made which render a comparison of the two series only an approximation.

This method consisted of making a series of prisms 2¾ ins. square and 13⅞ ins. long, the ends of which were prepared for the various bonds tested and a second prism of the same dimensions added. The pieces were then allowed to set for a time before being broken.

The apparatus for testing consisted of a socket into which the test piece was set vertically, a cross-arm attached in a horizontal position to the top of the test piece, and a pail suspended from the end of this cross-arm into which sand was gradually poured until its weight was sufficient to break the prism in flexure. A counterweight was applied to the cross-arm on the opposite end to that from which the load was suspended, this counterweight being so adjusted as to balance the horizontal system, exclusive of the applied weight.

The material used in making the test pieces was a mixture of one part Portland cement to two parts of clean sharp sand, care being exercised to secure a uniform quality of each. A mortar of this character, rather than a concrete, was chosen in the belief that a more uniform structure could be obtained which in test pieces of so small a cross-section was important. In practice, moreover, the surface to be treated is usually finished with cement mortar, so that actual conditions of surface were obtained in the test pieces. This mortar was placed in the forms wet, being tamped only enough to drive out air-bubbles. This method was followed also with the idea of obtaining a uniform structure by eliminating the possibility of unequal density in the pieces which might result otherwise from variation in the amount of tamping. The first half of the block was molded in a horizontal position, the second half in a vertical.

In these experiments five test pieces of each variety were made. The first sections were allowed to set 14 days, being kept moistened during this time. The second sections were then placed and the prisms allowed to set an additional 21 days before breaking, being kept moistened during this time also.

The first set, designated (A), was made up with the end of the first section roughened with a cold chisel, the cuts varying from ¼-in. to ½-in. in depth.

The second set, (B), was made up with the end of the first section smooth but covered with a cement paste to a depth of ⅛-in.

The third set, (C), was made up with the end of the first section moistened only.

The fourth set, (D), was made up with the end roughened as in (A) and covered with cement paste as in (B).

The fifth set, (E), was made up with a patented bonding solution (Ransomite) according to the directions given by its makers for its use. The end of the first section was first thoroughly cleaned, the solution was then applied and after a short time washed off. A thin cement grout was then rubbed in and was followed by an application of cement paste to a depth of about ¼-in. The action of this bond is apparently the formation of pores by the application of the solution, the filling of these pores by the thin grout and the confinement of this grout in the pores by the cement paste, which acts also to strengthen the bond.

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*Junior Engineer, U. S. Engineer Office, Cleveland, O.

The sixth set, (F), was made up with a bonding groove in the end of the first section. This groove extended lengthways across the piece and was ⅞-in. wide and ⅞-in. deep. In breaking, the test piece was so placed that the cross-arm of the breaking device was at right angles to the long dimension of the groove.

The seventh set, (G) was made up full length, 27¾ ins., without a bond. This set was broken at the age of 21 days, so that it approximated the average age of the test pieces made in two sections.

All of the full length pieces broke approximately at their centers and the other sets broke without exception at the bond.

The values of the various breaking loads are shown in the accompanying table, as are values of tension in the outer fiber, this latter value being computed in the manner noted in the previous article, that is, by taking account of the combined stresses due to dead load of the centrally applied testing apparatus and to the eccentric load of the sand in the pail.

Examination of the results shows that in each set of five there are one or two pieces which break under a load widely different from the others. For this reason it was considered that a more reliable average value could be obtained by taking the mean of those three values most nearly alike, the other two being considered eccentric test pieces.

There is apparently a very clean-cut difference between the strength of various bonds. The series designated (C) made up by applying new mortar to the old without other preparation than wetting were so weak that all of them broke in handling, or under load of not more than two or three pounds. Series (A) and (B) show about equal strength, while (D), a combination of the two preceding methods, shows almost twice the strength of either, singly, or about 90% of the strength developed by the full length pieces. Series (E), those bonded with the patent solution, show very good results, the strength of bond being equal to the greatest obtained by the other methods. Series (F) show a strength about equal to that of series (A) and (B).

While experiments of so limited character are not absolute in their results, it may be concluded with some degree of certainty:

(1) That the bond existing between new mortar, or concrete and old, where the old surface is smooth, is very slight.

(2) That about one-half of the strength of the concrete is developed in a joint bonded (a) by roughening the old surface; (b) by applying a layer of cement paste; (c) by providing the old surface with a bonding groove.

(3) That a large part of the strength of the concrete, perhaps as much as 90%, is developed where the old surface is roughened and a layer of cement paste is applied.

(4) That such a solution as "Ransomite" practically takes the place of the roughening, since a bond made with it is otherwise similar to the one made in these tests by roughening the old surface and applying a layer of cement paste.

TABLE SHOWING EFFECT OF VARIOUS METHODS OF JOINING NEW CONCRETE TO OLD.

Designation.	Character of joint.	T Tension in outer fiber, lbs. per sq. in.	(a) Average.	(b) Average of three nearest tests.	% of full strength developed according to (a).	% of full strength developed according to (b).
A_1	End roughened and wet.	158	....	....	....	....
A_2		123	....	....	....	....
A_3		87	....	....	....	....
A_4		124	....	....	....	....
A_5		128	124	125	49%	49%
B_1	End smooth and treated with neat cement grout.	119	....	....	....	....
B_2		131	....	....	....	....
B_3		207	....	....	....	....
B_4		82	....	....	....	....
B_5		124	133	125	53%	49%
D_1	End roughened and treated with neat cement grout.	279	....	....	....	....
D_2		211	....	....	....	....
D_3		237	....	....	....	....
D_4		225	....	....	....	....
D_5		227	236	229	94%	90%
E_1	End smooth and treated with "Ransomite."	232	....	....	....	....
E_2		128	....	....	....	....
E_3		220	....	....	....	....
E_4		231	....	....	....	....
E_5		146	191	228	76%	90%
F_1	End previously prepared by being molded with a bonding groove.	173	....	....	....	....
F_2		133	....	....	....	....
F_3		120	....	....	....	....
F_4		128	....	....	....	....
F_5		110	133	127	53%	50%
G_1	Full length prisms.	255	....	....	....	....
G_2		230	....	....	....	....
G_3		249	....	....	....	....
G_4		271	....	....	....	....
G_5		257	252	254	....	....

THE WASHINGTON MILLS DYE-HOUSE.

An unusual composite structure was constructed recently for the American Woolen Co. at its Washington Mills, Lawrence, Mass., as a dye-house. The building covers over an acre of ground, being 529 ft. long by 111 ft. wide, out to out, and for the greater part of its length is only one story high. It has brick walls footing on concrete and rubble foundation piers, steel roof-trusses, a reinforced-concrete roof, and a wooden shelter roof. The space between the concrete roof (more properly ceiling) and the wooden roof forms a dead air space to insulate the interior thoroughly in the matter of heat and thereby prevent condensation of the highly humid air in the dye-house; at the same time the interior of the building is completely fireproof.

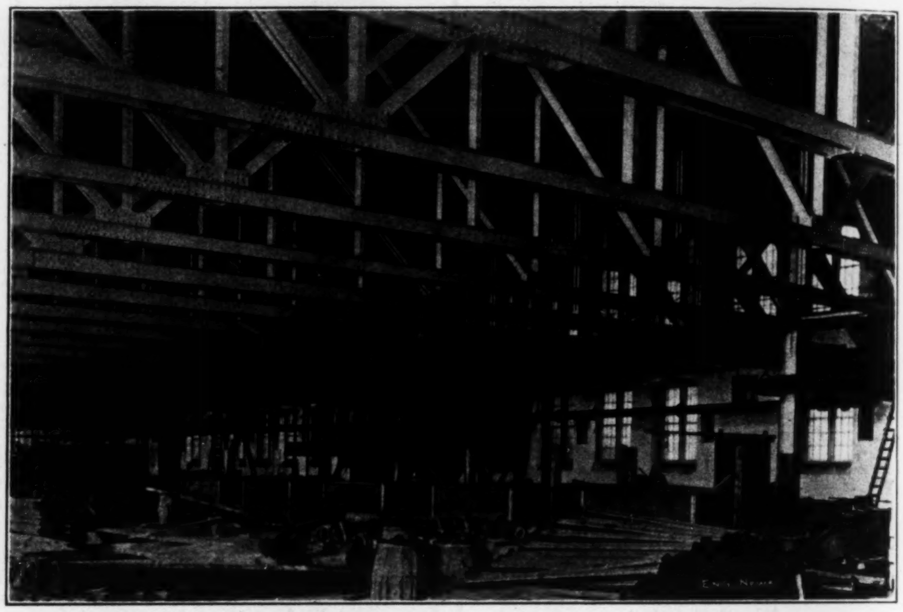

FIG. 1. STEEL TRUSSES AND REINFORCED-CONCRETE CEILING, WASHINGTON MILLS DYE-HOUSE.

The sketches in Fig. 2 illustrate the typical construction of the building. The walls are 36 ins. thick to the underside of trusses, in the single-story part. One end of the building, for a length of about 90 ft., is two stories high, and here the walls are 36 ins. in the first story and 32 ins. in the second; the roof section of the walls is 28 ins. thick. The two-story portion consists of reinforced-concrete columns carrying reinforced-concrete beams, on which rests the wooden flooring. Similar construction is used to form a second floor over a small section of the main or one-story part of the building, partitioned off to serve as office below and storeroom above. The roof over the two-story portion is of reinforced concrete, beams running transverse to the building at 10-ft. spacing being covered by a slab.

The main part of the building, one story high, is clear of columns (except in a few instances where columns were necessary to support tank framing), and is spanned from wall to wall by steel trusses, 107 ft. long c. to c. of bearings and 10 ft. apart. These are parallel-chord Pratt trusses 12 ft. 8¾ ins. deep o. to o., with top and bottom chords of two 12-in. channels reinforced by a cover plate where needed, inclined end-posts of similar make-up, and double-angle web-members. Immediately over these trusses is a reinforced-concrete ceiling, designed for a load of 75 lbs. per sq. ft., and about 2 to 3 ft. over this is a timber roof. The walls of the building and the timber roof can be raised one story at a later time, and the present ceiling will then form a working floor for the second story. As built at present, the space between ceiling and roof forms a dead-air space which serves as heat-insulation for the first story and prevents trouble from condensation.

This ceiling consists of a reinforced slab 5 ins. thick for the most part but 6 ins. thick near the walls, spanning from truss to truss. Directly on the top chord of each truss is a concrete beam about 8 × 12 ins. in section, running the full length of the top chord and spanning from the first panel-point at each end to the wall, over the inclined end-post. The slab is reinforced with ½-in. square twisted rods 6 ins. on centers running from truss to truss, supplemented by ⅝-in. rods 5 ft. long as upper reinforcement over the trusses; in the other direction there are ½-in. rods 12 ins. on centers, parallel to the trusses. In the bay at the end of the building the span is longer than the normal 10 ft., as the last truss is 14 ft. 8 ins. from the inner face of the end wall. Here the slab is supported by reinforced-concrete beams spanning from truss to wall.

The slab was built in sections 30 ft. long, making a separation over every third truss, so as to leave joints for expansion and contraction.

Over each truss are three short 4-in. pipe columns resting on the concrete ceiling. These carry a long-leaf pine roof beam in the vertical plane of the truss. A roof of 3-in. splined plank is nailed on these beams, and is made tight by a 6-ply tar and gravel roofing. The timber roof is pitched on a very flat pitch from the middle to the eaves, but the concrete ceiling and the truss chords are level.

There is a basement under the building for its whole length, in which are brick piers for supporting the first floor. The latter is of wooden beam-and-plank "mill construction," with Southern pine beams, 3¾-in. spruce plank and ⅞-in. oak wearing surface. Brick walls generally 12 ins. thick serve as foundations under the dye-kettles and machines.

The building is equipped with live-steam and exhaust-steam lines, shafting to drive the machinery, a plenum hot air system for heating, and a set of air exhausting fans. The steam lines are carried overhead; the live-steam main piping comprises five longitudinal lines of 3-in. and 4-in. main just below the trusses fed from a 10-in. supply main, and the exhaust piping three longitudinal lines varying from 4-in. near the ends of the building to 10-in. near the center, fed from a 24-in. main. The live-steam main enters the building from the boiler-house at the two-story end. The exhaust main enters from the engine-room at a point about one-third the length of the building from this end. Cross-connection between live and exhaust-steam pipes at various points, fitted with reducing valves, provide for supplying low-pressure steam to the exhaust system when needed.

The shafting is arranged in three to five longitudinal lines, to suit the arrangement of dye-kettles and other machines. The shafts are hung to the bottom chords of the trusses by self-alining hangers, bolted to wood-blocks fastened to the truss chords. The shafting is made up in lengths of 20 ft., connected by couplings. It is driven by three electric motors of 175 HP. each.

In the middle of the building are located two small vertical engines driving exhaust fans supported on opposite sides of a gallery. Two similar fans are mounted on smaller galleries in other parts of the building. These fans have open suction, drawing the air directly from the upper part of the house. They discharge through the roof. Uniformity of ventilation is secured by the distribution of these fans.

The heating equipment comprises three fan-rooms under the floor, containing fans and exhaust-steam heating coils; a hot-air duct under the floor along one of the longitudinal walls; and upcasts arranged in the alternate brick pilasters of this wall (20 ft. apart) discharging into the building above head level. The pilasters are, of course, suitably enlarged in section in their lower portions to contain these upcasts. The hot-air duct in the basement is square in cross-section, about 7 × 5 ft. inside, and has walls of reinforced concrete except on the outer side, which is formed by the concrete foundation wall of the building. The fan-rooms are partitioned off from the basement by 1¾-in. cement-plaster partitions. Each room contains two sets of fans and heaters, each of which comprises two engine-driven fans and the necessary coils. The exhaust from the fan engines, supplemented when necessary by steam from the main exhaust line, is used in the heating coils.

Mr. Charles T. Main, of Boston, Mass., designed this dye-house. The general contractor was the E. W. Pitman Co., of Lawrence, Mass., the foundation work being done by W. N. Pike & Sons of the same city while the roof-trusses were built by the New England Structural Co., of Boston, Mass. The water piping was put in by W. F. Rutler Co., of Lawrence, and the steam piping by the Merrill Co., of Boston. The B. F. Sturtevant Co., of Hyde Park, Mass., installed the heating and ventilation equipment. A complete sprinkler system was put in the building by the General Fire Extinguisher Co., of Providence, R. I.

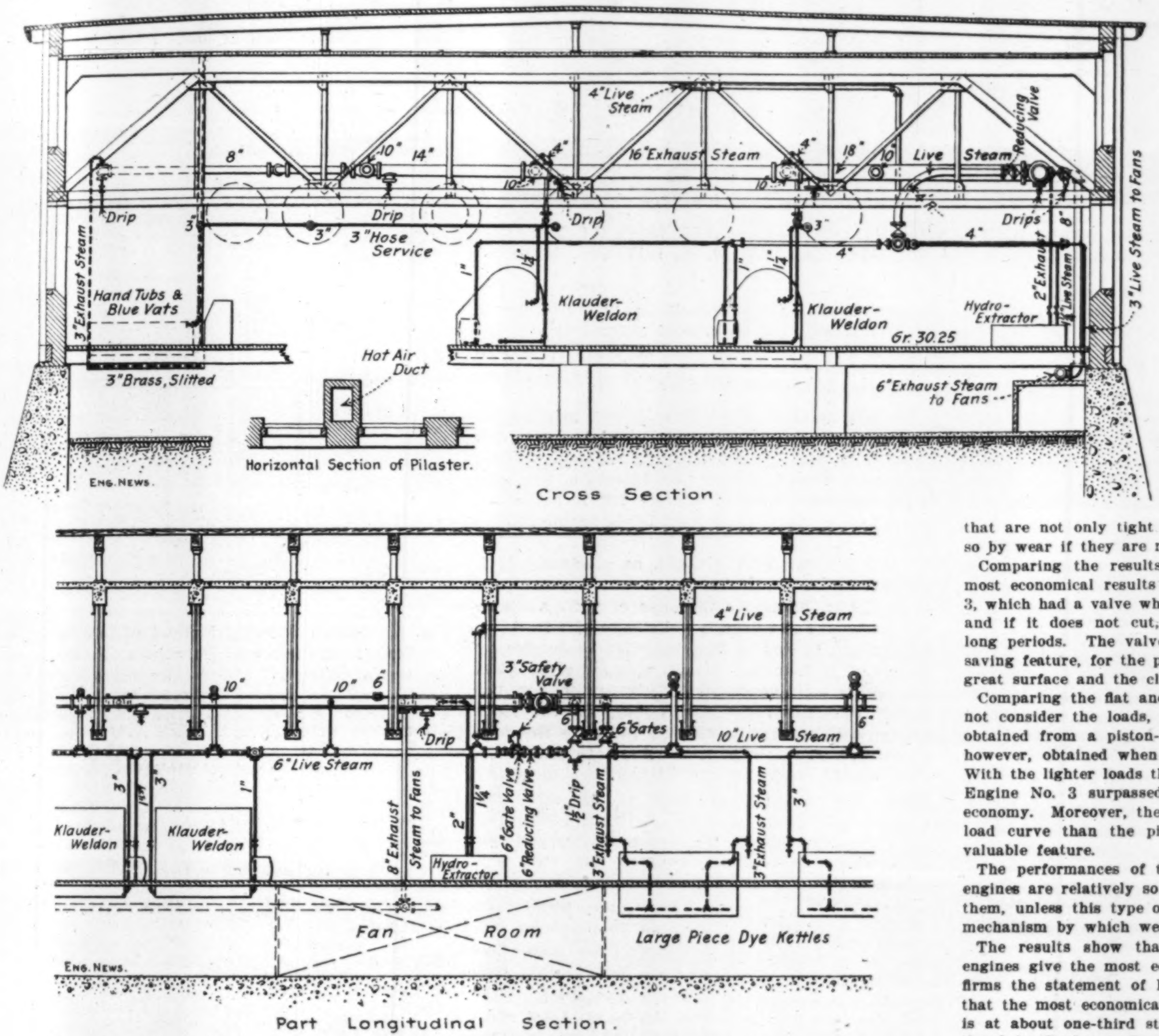

FIG. 2. SECTIONS OF DYE-HOUSE FOR WASHINGTON MILLS OF AMERICAN WOOLEN CO., LAWRENCE, MASS.

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A "TRACKLESS" TROLLEY line has been projected from Chattanooga, Tenn., to the top of Walden's Ridge, a distance of some 15 miles. Current reports state that the cars will carry 30 persons each and will receive power from a double trolley. It is also reported that the cars will be steered much like an ordinary automobile. The cars will run on ordinary good roadway. The project is being promoted by Mr. D. J. Duncan, Chattanooga.

ECONOMY TESTS OF HIGH SPEED ENGINES.*

By F. W. DEAN,† M. Am. Soc. M. E., and A. C. WOOD,‡ M. Am. Soc. M. E.

It became necessary to make tests of several high-speed engines, direct connected to electric generators, for the purpose of determining the quantity of steam used per I. HP.-hr. and per KW.-hr. The idea was to take the engines as they were found, in order to ascertain their economy after having been run for some time.

[The authors then give a detailed description of the engines and tests which we condense as follows: Seven non-condensing engines were tested; three with single flat valves; one with four flat valves; two with single piston valves; one with two flat inlet and two rotating exhaust valves. These units range from 75 to 150 KW. and are of types and makes frequently used in isolated plants in office buildings and elsewhere. They had been in actual running service for periods of from 719 to 32,000 hours. The results show the mean water rate of the seven engines to be about 34 lbs. per I. HP.-hr. at full load. The authors' conclusions will be given in their own words.—Ed.]

There are several striking features in these results, as follows: They show that efforts to realize economy by duplication, or multiplication, of parts, even if ports are shortened and clearances reduced, accomplish nothing. The duplication of valves used in both four-valve engines simply increased the opportunity for leakage.

After considering these tests, we do not hesitate to advise builders to abandon four valves for high-speed engines unless they are prepared to build a really high-class engine having four Corliss or gridiron valves, made and fitted in the best manner. Even then it would be necessary for them to prove their case. Steam engines of whatever type should have valves that are not only tight originally, but that will become so by wear if they are not so originally.

Comparing the results of the flat-valve engines, the most economical results were obtained from Engine No. 3, which had a valve which automatically takes up wear, and if it does not cut, must maintain itself tight for long periods. The valve of this engine is evidently its saving feature, for the ports are long and tortuous, have great surface and the clearance volume must be large.

Comparing the flat and piston-valve engines, if we do not consider the loads, the most economical result was obtained from a piston-valve engine. This result was, however, obtained when the engine was heavily loaded. With the lighter loads that are comparable the flat-valve Engine No. 3 surpassed the piston-valve Engine A in economy. Moreover, the flat-valve engines give a flatter load curve than the piston-valve engines, which is a valuable feature.

The performances of the perfectly balanced flat-valve engines are relatively so poor that it seems to disqualify them, unless this type of valve can be made with some mechanism by which wear will not increase leakage.

The results show that heavy loads with high-speed engines give the most economical results, and this confirms the statement of D. K. Clark in the early fifties that the most economical point of cut-off in locomotives is at about one-third stroke. This was again substantiated by Professor Goss with the experimental locomotive at Purdue University.

One interesting thing about the results is that no stationary high-speed engine is as economical as passenger locomotives that are in good order. We expect that such locomotives will use as little as 26 lbs. of steam per indicated horse-power per hour, and better results have been obtained. This economy was realized before very high steam pressures were used.

In regard to the relative economies of flat and piston-valve engines, we are inclined to believe that the former are the more economical, if the valves are self-adjusting with wear, and are of a good design. They must have less port surface and less clearance, and can be made to adjust themselves for more wear than piston valves.

Persons who are familiar with guarantees of steam consumption which accompany sales of high-speed engines are aware that these guarantees are usually met in shop tests, but these tests show that no engine realized economies which would have been guaranteed.

From the results we are justified in thinking that most high-speed engines rapidly deteriorate in economy.

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*A brief abstract and summary of a paper presented at the spring meeting of the American Society of Mechanical Engineers, Detroit, Mich., June 23-26.

†Boston, Mass. ‡Philadelphia, Pa.

LOWERING A 24-IN. WATER PIPE IN STREET GRADE CHANGES AT DETROIT, MICH.

By W. F. WARD.*

The separation of street and railroad grades is being accomplished in Detroit, by lowering the streets and elevating the railroad tracks by such amounts as to give a clear head room of 13 ft. between the pavement and the bottom of the railroad bridges. This lowering of street grades necessitates a lowering of water mains to conform therewith, and because of the unusual character of much of the work the writer has thought that the details of a portion of it would be of more than local interest.

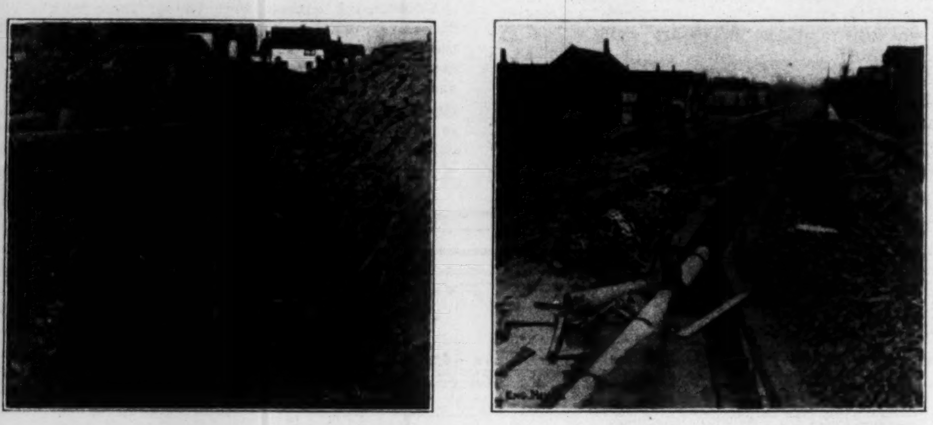

FIG. 1. AND 2. OLD AND NEW GRADE AND ALINEMENT OF 24-IN. WATER MAIN AT THE INTERSECTION OF VINEWOOD AVE., AND THE MICHIGAN CENTRAL R. R., DETROIT, MICH.

The earth is removed from the cut by means of a steam shovel, drag scrapers and dump wagons. This work is performed by the city, and with it the Board of Water Commissioners is in no way concerned. Since the mains suffer more or less from rough handling, it is necessary to shut off the affected section and supply consumers by means of temporary connections, which consist of galvanized piping laid across the lawns, etc. This temporary system is installed before the work of excavating the street has begun. Upon completion of the excavating, the Board of Water Commissioners commences operations, employing in this work one of its regular pipe-laying gangs, together with such extra help as is needed.

As a good specific example of this work the grade separation at the intersection of Vinewood Ave. by the Michigan Central R. R. has been taken.

Here the completion of excavation left a stretch of 24-in. pipe 688 ft. long to be lowered to grade. Of this amount it was necessary to relay 149 ft. in a new location, forming an elbow, as shown in Figs. 1 and 2, in order to avoid bridge piers and abutments; which were to come later. A trench was excavated about the pipe to be lowered, lines and grades for this purpose having been furnished by the Engineering Department, and upon completion of this work the pipe was left in the condition shown by Fig. 5. (The method of setting grade stakes in the bottom of the trench is shown by Fig. 4. On completion of the preliminary trenching the pipe line for a considerable distance was supported on earth piers, as shown in Fig. 6. The earth forming these piers was the so-called blue clay of this region, found at a depth at this point of about 10 ft. This clay is tenacious, stiff, blue gray in color and is best worked with short-handled concave-bladed clay spades and clay forks. In dry weather it holds its form, but rain will cause it to soften, shell off or crumble. On this account the holes between piers were kept dry by pumping and for fear of rain the pipe was supported by blocking.

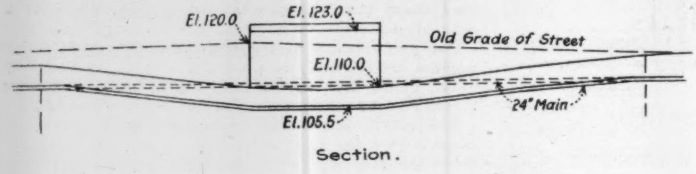

FIG. 3. CHANGES IN GRADE AND ALINEMENT OF WATER MAIN AT THE INTERSECTION OF VINEWOOD AVE., BY THE MICHIGAN CENTRAL R. R., DETROIT, MICH., MADE NECESSARY BY THE SEPARATION OF STREET AND RAILWAY GRADES.

In this particular location it was possible by laying the 149-ft. piece, which had to be relaid, separately and by not shutting off and cutting out the affected section, to maintain the pipe under pressure and in service for a period of twelve days; until the actual lowering operations took place.

The alinement of the main, as originally laid, not having been maintained, it was necessary to shift 120 ft. of pipe a distance of 3 ft. horizontally as well as to drop it a distance of 6 ft. 6 ins. vertically. It was at first intended to do this by means of jack-screws ranged along the pipe, but the shift was accomplished by removing the earth from the tops of the piers on the sides towards which it was desired to cause the pipe to move, and allowing it to slide into line of its own weight, which it did without cracking any hubs. Fig. 7 shows the pipe at this point before shifting, while Fig. 8 shows the work about completed on one section.

The pipe was then lowered to place by distributing the men four at each pier, two on each side of the pipe, working face to face with long-handled shovels. The foreman and two assistants stationed themselves upon the pipe. About 25 piers were worked in this manner at one time, work being begun at the fixed end, i. e., the end already at grade and working towards the free end, thus allowing the pipe to creep forward towards the free end, and thus preventing the formation of humps or bulges in a vertical plane which, if they once appear, are difficult to get rid of. The actual time of lowering the pipe was two days and seven hours, and the work was accomplished without accident or breakage. Fig. 9 shows the portion of original line replaced by the relaid portion, and gives a good idea of the change in grade. The water from the main, when cut off, was allowed to drain into the sewer in Vinewood Ave. through an open cut, this being afterward used for the location of a blow-off.

The accompanying table presents a summary of data of work at this particular track intersection.

SUMMARY OF WORK IN LOWERING AND REALINING WATER MAIN. INTERSECTION OF VINEWOOD AVE., AND THE MICHIGAN CENTRAL R. R., DETROIT, MICH.

Ft. relaid	149
Ft. lowered	688
Actual time of lowering	2 days 7 hrs.
Ft. lowered at one time	250
Time of preparation	[illegible] days
Average number of men employed	90
Cu. yds. of dirt excavated	1,270
Soil—Blue Clay.	
Width trench relaying	4'0"
Width trench lowering	6'0"
Average depth relaying	6'6"
Average depth lowering	8'0"
One rainy day during lowering.	
Precipitation	.25 in.

Date of beginning, Nov 1, 1907.
Date of completion, Nov. 22, 1907.

Personnel:

Foreman	1
Assistant to foreman	1
Calkers (experienced men)	6
Helpers (experienced men)	3
Watchmen	2
Laborers (35% experienced) (8-hour day).	75

Cost of Labor of Preparation:

3½ days at	$65.00	per month
12½ " "	60.00	
3½ " "	55.00	
16¾ " "	50.00	
40¼ " "	2.25	per day
589 " "	2.00	

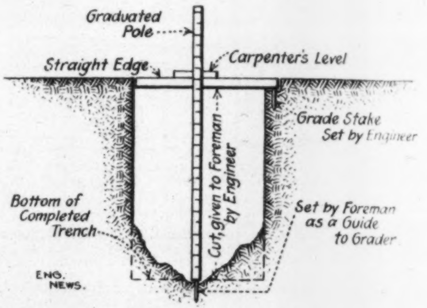
Graduated Pole
Straight Edge
Carpenter's Level
Grade Stake Set by Engineer
Cut, given to Foreman by Engineer
Bottom of Completed Trench
Set by Foreman as a Guide to Grader
ENG. NEWS.

Fig. 4. Sketch Showing Method of Setting Grade Stakes at Bottom of Trenches. Detroit Street Grade Changes.

Cost of Labor of Lowering, Relaying and Backfilling:

6 days at	$60.00	per month
6 " "	65.00	
6 " "	55.00	
11½ " "	50.00	
29 " "	2.25	per day
561 " "	2.00	
Watchmen included in labor at	2.00	

Make-up of Gang:
1% English foreman.
30% Huns { young men.
fairly good.
29% Poles, good, experienced.
15% Germans, fair.
15% Irish { calkers.
laborers, old men.
10% Italians, no good.

Supplies:
2 tons coal.
15 pigs lead.
25 gals. kerosene.
5 gals. gasoline.

A UNION RAILWAY STATION AT LEIPZIG, Germany, which will be among the largest in the world, is now in course of construction. At present there are in Leipzig five terminal stations, all of which are to be removed after the new one is put in service. This latter is to have 26 parallel tracks, all on the same level, to accommodate the trains of 13 different lines, and between each pair of tracks is to be a walk about 40 ft. wide, so that the total width of the trainshed will be nearly 1,000 ft. The main facade of the building will be 1,115 ft. wide, over 350 ft. greater than the 760-ft. facade of the new Union Terminal at Washington, D. C., at present the largest in this country. The total cost of the Leipzig terminal and approaches will be $31,600,000, of which $12,000,000 will be furnished by the state of Saxony, $12,800,000 by Prussia, $4,800,000 by the city of Leipzig, and $1,200,000 by the imperial post-office. The above information is given by M. Victor Cambon in a paper published in the Bulletin of the Société des Ingenieurs Civils de France for April, 1908.

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*232 Jefferson Ave., Detroit, Mich.

AIR WASHING AND HUMIDIFYING, AND SOME OF ITS APPLICATIONS TO INDUSTRIAL PURPOSES.*

By W. A. ROWE.†

In introducing a subject of this nature, attention should be called to the fact that the air washer has been developed through the use of the fan system of heating and ventilating. For years it had been taken for granted that good ventilation must be obtained, even at the expense of cleanliness.

This is particularly noticeable in communities where soft coal is used. The necessity for properly cleansing the air which is taken into buildings has long been felt, and many were the devices used to effect this. Prominent among them might be mentioned the use of cheesecloth screens, long bags of the same material, and coke filters. These all had the disadvantage of offering too great a resistance to the passage of the air, besides giving only crude cleansing effect. They were also unsatisfactory in that they did not affect the humidity of the air to any extent.

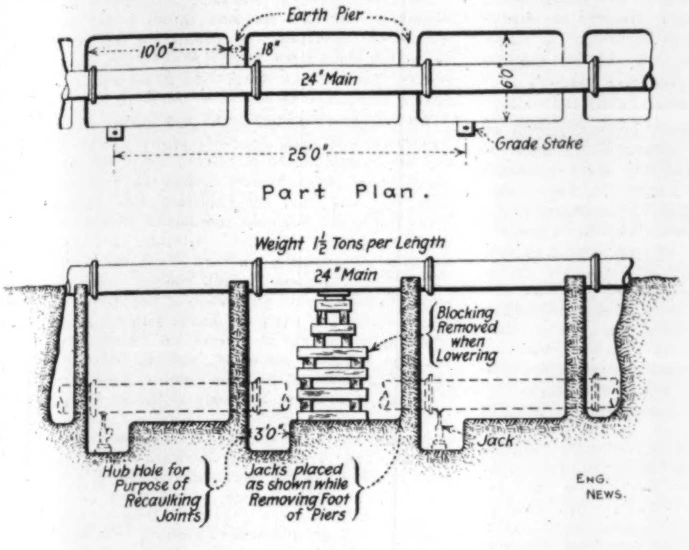
Earth Pier
10'0"
18"
24" Main
6'0"
25'0"
Grade Stake
Part Plan.
Weight 1½ Tons per Length
24" Main
Blocking Removed when Lowering
3'0"
Jack
Hub Hole for Purpose of Recaulking Joints
Jacks placed as shown while Removing Foot of Piers
ENG. NEWS.
Part Longitudinal Section.

FIG. 5. METHOD OF EXCAVATING TRENCHES AND SUPPORTING PIPES IN THE WORK OF LOWERING WATER MAINS AT DETROIT, MICH.

REGULATION OF HUMIDITY DESIRABLE.

The desirability of properly controlling the humidity of buildings has been well brought out in a paper by Dr. Henry Mitchell Smith, read by him before the Brooklyn Medical Society in May, 1903. In it he points out that the sensible temperature of the human body more nearly corresponds to the temperature indicated by the wet bulb of a hygrometer, rather than to the dry-bulb temperature.

Air at 68° F. and containing 50% humidity, feels more comfortable than air at 75° and having but 20% humidity. Extremely dry air produces a more rapid evaporation from the mucous membranes as well as from the entire surface of one's body. This causes the lower sensible temperature and, in the case of the former, has an unhealthful effect.

It is this condition which is obtained where external air at a low temperature is heated to the temperature usually found in warmed buildings. If we take outside winter air at 30° F. and 80% saturation, we find it contains 1.5 grains of moisture per cu. ft. If its temperature is raised to 70° without adding any moisture to it, we find that its percentage of saturation is but 19.5, because of the fact that air at 70° can absorb 8 grains of moisture. We can thus see that not only is it desirable to humidify the air, but also to regulate the degree of humidity.

THE WATER SPRAY.

These considerations all lead to the use of a water spray by which to cleanse and humidify at the same time. There are various essential features which must be incorporated in the design of such an apparatus to make it successful, not only from a theoretical point of view, but also from the practical or commercial standpoint. In discussing these features the writer will describe one apparatus in particular which, by reason of its having met all the requirements successfully, has enabled its manufacturer to realize certain results of great commercial importance. I refer particularly to the apparatus manufactured by the Buffalo Forge Co.

INTIMATE CONTACT BETWEEN AIR AND WATER.

The first requisite of a successful washer is an intimate contact between the air and the water. The more finely the water can be divided the greater will be the contact surface and, consequently, the greater degree of success realized. Hence a finely divided mist is essential. A nozzle has been devised with which an almost invisible, finely-divided spray is obtained with a pressure of but 20 lbs. per sq. in. In this nozzle the outlet orifice is but $^3/_{32}$-in. in diameter, yet it will deliver 3.5 lbs. of water per min. The result is obtained by giving the water a centrifugal motion which causes it to burst into spray.

In the completed air washer these nozzles are spaced 2 per sq. ft. of cross-sectional area, a velocity of from 400 to 450 ft. per min. through the washer being maintained. Thus, where 42,000 cu. ft. of air per min. is to be handled, a cross-section area of 93.5 sq. ft., with 188 nozzles, is provided.

SEPARATION FROM AIR OF EXCESS MOISTURE.

The second important feature to be secured is thorough separation of the excess free moisture which is carried along by the air current. This is done by a series of galvanized plates, placed ⅞-in. apart and containing bends 2 ins. in length. There are usually six sections, the first three allowing a film of running water to cover them completely. The last three have slight projections which completely separate all traces of free moisture from the air. This eliminator thus presents a large washing surface upon which every particle of foreign matter will impinge.

CONTROL OF HUMIDITY.

The proper control of the humidity is accomplished by controlling the temperature of the air in the spray chamber, and taking advantage of the law that air at any given temperature has a definite moisture-absorbing capacity, this amount increasing as the temperature is raised. For example, air at 50° and 70° F. can absorb 4 and 8 grains of moisture, respectively, per cu. ft., at which point it becomes saturated. If it is desired to maintain 50% humidity at 70° F. in a building, it is only necessary that the air in the spray chamber be saturated at a temperature of 50° F., and afterwards raised in temperature to that of the room, without the addition of any more moisture. In this way any desired humidity can be maintained. The best results are obtained by dispensing with tempering coils entirely, depending on heated spray water to bring the temperature of the air up to the desired point. This circulating water can be heated in any type of heater, its temperature being controlled automatically by means of a thermostat in the spray chamber.

Fig. 6. Water Main Resting on Earth Piers, Prior to Lowering, Detroit, Mich.

REQUIREMENT OF DESIGN AND USUAL EQUIPMENT

The apparatus must be free from all necessity for constant personal attention. It must be easily accessible, the nozzles easily cleaned if such necessity should arise, and ample provision be made for keeping foreign matter out of recirculating water.

Usually a motor-driven centrifugal pump is used, the water collecting in a settling tank at the base of the washer and being recirculated. Usually the settling tank is flushed out once a week and entirely new water provided.

Fig. 9. Original and Relaid Portions of Water Main; Intersection of Vinewood Ave., and Michigan Central R. R., Detroit, Mich.

Some idea of the extent to which the cleansing effect may be carried may be obtained from recent tests made on the Carnegie Branch Library at St. Louis, by Wm. H. Bryan, consulting engineer. While not going into details it is sufficient to say that, using lampblack, over 99% was removed by the washer.

CONDENSATION OF HUMIDIFIED AIR MAY BE PREVENTED.

Objection has been raised that excessive condensation on windows might result from humidifying the air. It has been found that this can be obviated by maintaining a temperature in the spray chamber never higher than a mean between the temperature of the external air, and that of the room. For example, if we are maintaining a temperature of 70° F. in the building, with an outside temperature of 10°, a temperature of 40° in the spray chamber will prevent any condensation or frosting on the windows. This is true because the glass itself is at a temperature midway between the two extremes and, therefore, is unable to lower the temperature of the air to its dew point.

FIGS. 7. AND 8. RELINING A WATER MAIN PRIOR TO LOWERING; DETROIT STREET GRADE CHANGES.

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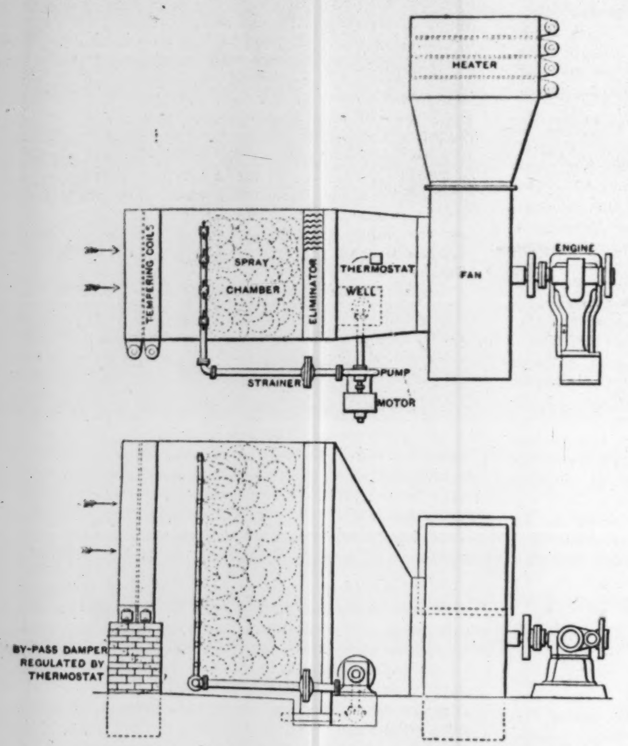
*Condensed from a paper read before the Ohio Society of Mechanical, Electrical and Steam Engineers.

†Buffalo Forge Co., Cleveland, Ohio.

HUMIDITY LOWERS TEMPERATURE OF AIR.

As a rule the fan system of heating and ventilating is used only when the outside temperature is under 60° to 65°. Under these conditions an excessive humidity is absolutely impossible because of the fact that the air is raised in temperature before being brought into the room. When, however, the system is used throughout the year it oftentimes becomes desirable to get away from the high humidities quite common in warm weather. It is found that the external air can be appreciably lowered in temperature during the warm months because the air in passing through the washer absorbs some of the moisture. The latent heat to vaporize this moisture is furnished by the air itself, hence the lowering in temperature. It is found that an absorption of from 0.8 to 0.9 grain per cu. ft. gives a lowering in temperature of from 7° to 8°. Greater reduction in temperature may be obtained, providing, of course, the air already has not too high a percentage of humidity.



DIAGRAM, PLAN AND ELEVATION OF AIR WASHING AND HUMIDIFYING APPARATUS.

In the greater part of our warm weather this cooling effect is not accompanied by any unpleasant humidity. Where, however, this slight increase would cause inconvenience it is possible to produce a cleansing effect without appreciable absorption of moisture, with its consequent cooling effect, by merely flooding the eliminator plates and dispensing with the fine spray. Where exceptionally high humidities are encountered, it is possible to substitute a solution of calcium chloride, 28° Baumé. This solution will thoroughly wash the air without a particle being evaporated. It neither gives up nor will it absorb moisture.

In a recent test of the Carnegie Library installation, about which we have previously spoken, with an outside temperature of 86° and 40% humidity, an average temperature was maintained inside the building of 77.5° with 70% humidity, this being an average temperature decrease of 8.5°. It was found that a lower temperature was maintained in the room where the windows were kept shut.

EXTRACTING MOISTURE FROM AIR.

So far we have touched only on the humidifying or adding of moisture to the air. In some branches of industrial work it is necessary to extract the moisture from air, or to dehumidify it. This is particularly true in the case of drying many substances which cannot stand a high temperature. Among these might be mentioned gelatine and glue products, photographic paper, rubber, sulphur, matches, etc.

Where the material to be dried can stand the maximum probable temperature that we are likely to encounter in summer weather, say 90°, we can get sufficiently dry air at any time by the use of calcium chloride solution, 40° Baumé, in the air washer. This solution will extract moisture from the air, the amount depending on the strength of the solution. It is not necessary to use outside air in this instance. The air from the drying room can be returned to the washer where it is relieved of a portion of its moisture.

This chemical extraction of the moisture from the air liberates the heat of vaporization, which results in raising the temperature of the air itself. This warmer and dryer air is then returned to the drying room, where it absorbs additional moisture from the material being dried. Of course, the calcium chloride solution is being continually weakened while this cycle is progressing. It is necessary to use an automatically-controlled evaporator, to which the solution is returned and reconcentrated.

A more simple solution of this problem can be effected where a sufficient supply of cold water is available. With a temperature of water of 50° to 55°, it is possible to reduce the temperature of the air to 58° to 63°, leaving but 5.5 to 6.5 grains of moisture per cu. ft. in the air. By then reheating this air to 80° to 85°, we would have a 50% saturation, in which condition the air will readily absorb moisture. The large amount of cooling water necessary makes this plan too expensive in many localities, in which event the calcium chloride solution can be used with small expense.

LOW-TEMPERATURE DRYING.

Again we have materials, such as photographic paper, which must be dried at a relatively low temperature all the year round. A temperature not exceeding 57° is necessary or desirable. In cases like this, no external air whatever is used except in cold weather. The air from the drying room is recirculated through the washer, in which the circulating water is cooled by refrigeration. The lowering of the temperature of the air condenses the excess moisture in it. In a recent installation this water entered the spray chamber at about 35°. The air was reduced in temperature to 45°, at which temperature it contains 3.4 grains per cu. ft. at saturation. The air is then reheated to approximately 59°, when its percentage of humidity is 60. It is then returned to the drying room and the cycle repeated.

In connection with this last process it might be mentioned that a high degree of economy results from the fact that a back pressure of 45 lbs. may be carried on the refrigerating machine, whereas 15 lbs. is usually figured for ordinary refrigeration. We also have a maximum of efficiency in the transfer of heat or cold between the water and the air, because of the intimate contact between the two. When we realize the condition that usually obtains in refrigeration work, with the frost covering the pipes and cutting down the efficiency of the conducting material, the importance of this feature can be realized.

◆

RECENT WORK IN DRAINING MINES ON THE COMSTOCK LODE.*

By WALTER D. O'BRIEN.

The drainage of the Comstock mines 25 years ago was accomplished by a pumping plant the moving parts of which weighed 6,496,400 lbs. This enormous weight was raised and lowered 10 ft. nine times per minute. In the Cornish system of pumps then in use 2.7 miles of pump-rod were employed, which, with the balance-bobs, pumps, and moving parts, actually weighed 2,230 lbs. for every gallon of water raised. A train of cars nearly a mile long would be required to transport this machinery. Can one then wonder that when this stupendous plant was found inadequate, pumping ceased and the mines were allowed to fill with water?

The abandoned pumps, not including foundations installation, or freight, cost about $1,300,000. Their maximum pumping capacity all told was less than 5,400 gals. per min., raised to an average height of 1,152 ft. The cost of operating this plant was about $58,120 per month, or $697,440 per year. This did not include the cost of broken parts, but represented daily operating expenses for pumping alone. One would think that such a plant could pump the ocean dry, but it could not handle the water of the Comstock lode. The old records show that in almost every instance where any extensive prospecting work was tried on the lower levels, heavy flows of water were encountered.

In February, 1882, a heavy flow of water from the 2,810-ft. level of the Exchequer mine, estimated at 120 miner's inches, flooded the lower levels. The pumps were run to their full capacity, but the water still rose, and not being able with pumps and bailing tanks to control it, all pumping operations were stopped for good on March 28, 1882.

At the time the lower levels were abandoned, the pumps were daily discharging about 4,000,000 gals. hot water (in some places the water was, and still is, 160° F.) to the Sutro Tunnel level. The expense of these operations, under the then existing conditions, was enormous, so that finally one company after another withdrew its financial support, and the greatest of all gold and silver mines were practically abandoned, until the Comstock Pumping Association was organized in 1898.

This association was originally composed of 24 mining companies, and each company agreed to defray its percentage of the expense of unwatering the mines. The water then stood a few feet below the Sutro Tunnel level; in fact, some of the South End mines were then overflowing into the south lateral of the Sutro Tunnel.

The old superintendents who had charge of the mines previous to 1886 made extensive reports on the conditions and the amount of ore in reserve before the mines were closed down. These reports showed that $600,000,000 had been extracted from the Comstock lode, and that the lower levels had not been thoroughly prospected, on account of the flow of water. In many instances, known bodies of good milling ore were left in the old workings.

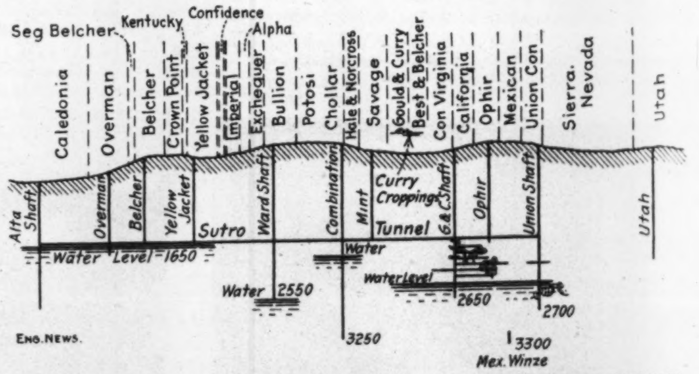
The best engineers in the country were then employed to devise ways and means of unwatering the mines and to design and equip the mines with the most modern pumping plants. For nine years, the Pumping Association has kept alive the old mines, and the fruits of its past efforts should be realized from one to three years hence.

Instead of trying to open each of the old shafts, groups of the companies combined to repair and operate through common shafts. The shafts that drain the different mines are the C. & C. shaft and the Ward shaft. The Union shaft is also below the Sutro Tunnel. The mines are now drained to the 2,550-ft. level of the Ward, 2,450-ft. level in the C. & C., and the 2,450-ft. level of the Union shaft.

By the use of hydraulic elevators, the water in the C. & C. shaft was lowered from the Sutro Tunnel level to the 2,150-ft. level, it having required 200 miner's inches under a pressure of 900 lbs. per sq. in. to accomplish this feat. On the 2,150-ft. level of this shaft, three $6^{11}/_{16}$ × 24-in. Riedler pumps have been installed. The station containing the pumps is 20 × 20 × 119 ft. in the clear. The timbers are 14 × 14-in. and lagged. These pumps have a capacity of 4,500 gals. per min. and are operated by means of three 200-HP. Westinghouse induction motors. They handle all the water in the North End mines, lifting the water from the 2,150 level to the 1,650 or Sutro Tunnel level, through which it is discharged.

By the use of hydraulic pumps, the water has been lowered to the 2,475-ft. level, where there is installed a hydraulic pump that makes one lift of 3,000 gals. per min. to the electric Riedler pumps on the 2,150 level. For operating this pump, 1,400 gals. per min. pressure water is used, under a pressure of 1,100 lbs. per sq. in.

On the 2,400-ft. level of the Ward shaft, there is an electric pump, operated by means of a 200-HP. motor at 1,720 r. p. m., that makes one lift of 900 ft. to the Sutro Tunnel level, pumping 600 gals. per min. On the 2,475-ft. level of this shaft, the finest electrically-driven pumping plant in the world is now being installed. The capacity of this one unit of the ultimate system is 1,650 gals. per min. The mine will be equipped with this unit to sink to the 3,100-ft. level, where a second unit will be installed.



SECTION OF THE COMSTOCK LODE SHOWING SUTRO TUNNEL AND DEEP SHAFTS.

The cost of this new pumping system, not including installation, was about $200,000, this price covering the two new units on hand and to be installed in the Ward shaft. Compare this cost with $1,300,000, the cost of the antiquated pumping plants. The capacity of the old installation was about 5,000,000 gals. daily, as against 9,000,000 gals., the capacity of the new installation.

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*Reprinted from the "Mining and Scientific Press" of San Francisco, Cal., June 13, 1908.

The following gives an itemized list of the present monthly expenditures and cost of operating the pumps to unwater the mines on the Comstock lode:

C. & C. SHAFT.

Electric power	$2,360
Water power	2,200
Labor	900
Labor changing throats	25
Repairs and renewals	400
Oil waste, etc	100
Compressed air	100
	$6,085

WARD SHAFT.

Electric power for pumps	$1,125
Electric power for compressor	400
Labor	660
Repairs, etc	100
Oil waste, etc	75
	$2,360

The total monthly cost of pumping is, therefore, about $8,445, as against $58,120, the former monthly expense of operating the abandoned pumping system, of little more than half the capacity of the new, which makes a saving of $596,100 per year. The present pumps also save from $50,000 to $100,000 on repairs and new parts not included in the above saving.

A hoisting plant recently installed in the Union shaft is operated by means of a 100-HP. General Electric motor. This hoist handled 20 tons an hour from the 2,000-ft. level, at a cost of about 3 cts. per ton for power. This does not include expense of engineering or mining. The hoist uses a continuous cable with two cages. A similar hoist is installed at the C. & C. shaft and is set up back of the old steam hoist now in use.

When the new pump is installed on the 2,475-ft. level of the Ward shaft, connections can be made with the Combination shaft and the mines can then be drained and explored to a depth of 3,100 ft. with good ventilation.

REMEDYING LEAKY ELEVATOR PITS.

By MYRON H. LEWIS.[*]

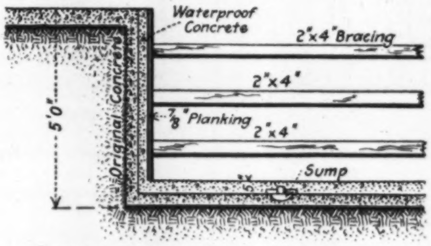
The G. Siegle Company's building, at Rosebank, Staten Island, is a three-story reinforced-concrete structure, designed for a color factory. The substructure of the building is 16 ft. below the grade and several feet below the ground water level. This substructure was originally waterproofed with an exterior bituminous coating, but through some undetermined cause water found its way into the cellar, and collected in the elevator pits to a depth of 3 ft. A system of continuous pumping had, therefore, to be adopted, to protect the machinery from the danger which thus menaced it. As leaky elevator pits are frequent sources of trouble and difficult to remedy the method of waterproofing here used may have some interest.

There were two pits repaired in practically the same manner. The first pit, 7 ft. 6 ins. × 8 ft. 6 ins. in plan, was built originally of reinforced concrete; one part cement, two parts sand, four parts gravel. In making the repairs for the waterproofing, there were cut out 4 ins. of concrete on walls and 5 ins. of concrete on floor. A sump hole was dug in the floor of the pit (see accompanying figure) 1 ft. square and 1 ft. deep. The forms were next placed, of the neat size of pit and square and plumb, with two pouring holes at top. Over the sump-hole there was then laid a thin board with a hole in the center. Over this sump was erected a cast-iron standpipe with an 8-in. flange having holes therein, as shown, and this was made tight to a 3-in. nipple, threaded full length, with cap loose, and a sheet of felt with holes bored through, placed underneath.

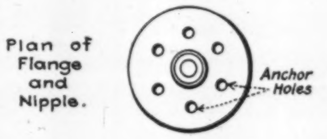
A flooring of concrete was then laid in the bottom of the pit, to the exact depth required. This was well puddled and tamped, especially around standpipe, and reinforced horizontally at least every 12 ins. with iron bars, these being placed within 1½ ins. of the surface. The composition of this concrete was one part cement, to which was added some "Hydratite" waterproofing compound, this being thoroughly mixed with the cement in the following manner: One barrel of cement was spread out flat, then 15 lbs. of the compound spread over evenly and turned over three times. To this was added two barrels of building sand, well dampened, spread out evenly and turned over three times. To this again was added three barrels of roofing gravel, spread out evenly and turned over three times, with enough water added to make a fairly wet composition.

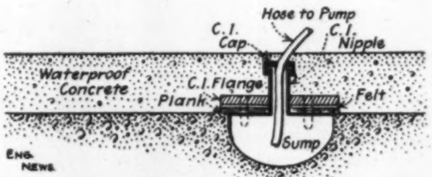
This was applied on the floor of the pit, and was well tamped and puddled, particularly around standpipe. The work was finished at 5 o'clock p. m.; the pouring of the wall was started at about 8 o'clock the following morning, finished at 10.30 o'clock and allowed to set until 11 o'clock the following morning. The following day, when the forms were taken away, the top part, on which it was impossible to place concrete, was finished with a cement mortar composition.

The object of the sump was to relieve the pressure of water which appeared in the pit at the time of the cutting out of concrete. Subdrains were dug around the entire pit on the interior leading to this sump, and the water was taken out through the standpipe for three or four days, allowing the concrete sufficient time to set. The cap was then screwed down and made watertight on nipple, and this completed the work.



Part Section of Elevator Pit





Details of Sump. (Enlarged)

Method of Waterproofing Leaky Elevator Pits at Siegle Factory, Staten Island.

The same method as above was followed in the other pit, except that 1½ ins. instead of 4 ins. was cut out of the wall. The reason for the difference was that in the latter case the walls were plastered, first with a rough coating of cement mortar mixed with waterproofing compound. Where the waterproofed cement mortar was applied to the old concrete surface, the latter was well prepared to receive it, to insure a strong and permanent bond. The surface was scratched and "hacked" and also washed with a solution made of a bonding compound, which was allowed to remain on about 10 minutes, and then the surface was thoroughly washed with water to remove all traces of the acid which enters into the composition of the material.

The top coat was well floated and troweled hard, making a smooth, hard finish, the entire operation resulting in a watertight job at the present writing.

The contractors for the work were A. C. Horn & Co.

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[*] Consulting Engineer, 701 Monolith Bldg., New York City.

SELF-INSURANCE OF STRUCTURES BY THE U. S. RECLAMATION SERVICE.

The U. S. Reclamation Service, in connection with numerous irrigation works it is building in the West, has adopted the plan of self-insurance against fire. From reports on the insurance status of its various structures, as submitted by its supervising engineers, the Service has made an interesting study for its periodical called the Reclamation Record. We quote as follows:

> From the data submitted, covering the calendar years of 1907 and 1908, much information has been gathered relative to precautionary measures employed or omitted on the various projects. So far losses to the Service have been small, when the number and character of structures in use is considered, and by the application of reasonable methods of protection, etc., it is hoped to maintain this low average in future.
>
> Determination of risks in the Service Insurance scheme is based on facts that have been developed by the Standard Commercial Underwriters' Associations. Each building reported is given a series of risk debits governed by conditions of construction, occupancy, exposure, etc., and from the total of these debits is deducted the total of credits from the various kinds of fire protection provided, and from non-inflammability of valuable contents and the quickness with which they might be removed in case of fire. The net debit is then multiplied by the value of the building and contents, and the product is taken as the "weight" of risk for the item. The sum of all these weights on a given project is taken as a unit weight for the project, and its relation to the sum of the weights of all projects is taken as a basis for computing assessments to reimburse 80% of losses sustained in each calendar year.
>
> The most important items of debit and credit affecting risks are given below:

DEBITS.

Construction.	Weight.	Chimneys:	Weight.
Brick	8	Brick	0
Frame	13	Terra-cotta or sheet-iron.	8
Tin, or Cor. iron roof	2	On brackets (additional).	2
Shingle or tar paper roof.	6		
Board roof	4	Heating:	
		Stove or open fireplaces.	4
		Hot air furnace	2
Lighting:		Occupancy:	
Gas or electricity	0	Office, warehouse or residence	5
Oil lamps	5	Mercantile store	10
Acetylene lamps	10	Mess or bunk-house	15
		Stable	20
		Steam power plant	50
General:		Exposure:	
Oils stored	5-25	(Distance to other risks.) 0 9 ft., according to nature of exposure, a weight of 8 to 40; 10 to 19 ft., 6 to 24; 20 to 50 ft., 2 to 12.	
Oil waste not removed	20		
Sweepings removed daily.	0		
Sweepings removed otherwise	7		

CREDITS.

	Per cent.
Gravity water system	20
Power water system	7
Fire hose in or near building	7
Patent chemical extinguishers	10-20
Paid fire department	20
Volunteer fire department	15
Watchman	12
Exceptional features	Arbitrary

A study of the examples below should be of interest as illustrating the increase of risk to a building by apparently trivial conditions.

A. Subject, a warehouse. Value of building and contents, $10,000.

	Debit.	Protective measures	Credit, per ct.
Frame construction	13	Gravity water supply	20
Corrugated iron roof	2	Chemical extinguisher	20
Occupancy (storage of ordinary supplies)	5	Fire hose near building.	7
Exposure, none in 50 ft.	0	Watchman	12
No lighting or heating	0		
Total debits	20	Total per cent. credit	39

20 less 39% = 12.2 × 10,000 (value) = 122,000, which is taken as the unit weight of risk.

Instead of above reasonable conditions, assume that the following changes were made. A shingle roof is substituted. A small room is arranged inside for the watchman, necessitating the use of a stove, a lamp and terra-cotta flue on brackets. Five barrels of oil are stored inside. A small table is built within 9 ft. on one side, a carpenter shop attached to another side and a granary and hay shed are located within 19 ft. of the rear. No fire protection is provided except a watchman. (All of these unfavorable conditions have been reported in a number of cases.) Result as follows:

B.		Protective measures.	Credit, per ct.
Construction (as before)	13	Watchman	12
Roof (shingle)	6	132 less 12 per cent. = 116.16 × 10,000 (value) = 1,161,600, or more than 9½ times the unit weight of the first example.	
Occupancy (same as bunk-house)	15		
Exposures, 24, 20 and 18	62		
Stove, 4; lamp, 5	9		
Terra-cotta flue, 8; on brackets, 2	10		
Occupancy (same as bunk-house)	15		
Oils stored	10		
Sweepings seldom removed	7		
Total debits	132		

The most important deduction to be made from the above is not the incidental increase of insurance assessment in the case cited, but the actual increase of risk to valuable property by such conditions.

POWER PLANT OPERATION ON PRODUCER GAS.*

By GODFREY M. S. TAIT,† M. Am. Soc. M. E.

The gas producer consists essentially of an apparatus arranged for the partial combustion of carbon, which result is achieved by means of a deep fuel bed, so arranged that while the free air is admitted to one side of the fire, allowing complete combustion in the first zone, the succeeding zones, containing carbon heated by radiation and convection, are utilized for the reconversion of the CO_2, back into a combustible gas by its coming in contact with the incandescent fuel, which is so arranged that no free oxygen has access to this part of the fuel bed.

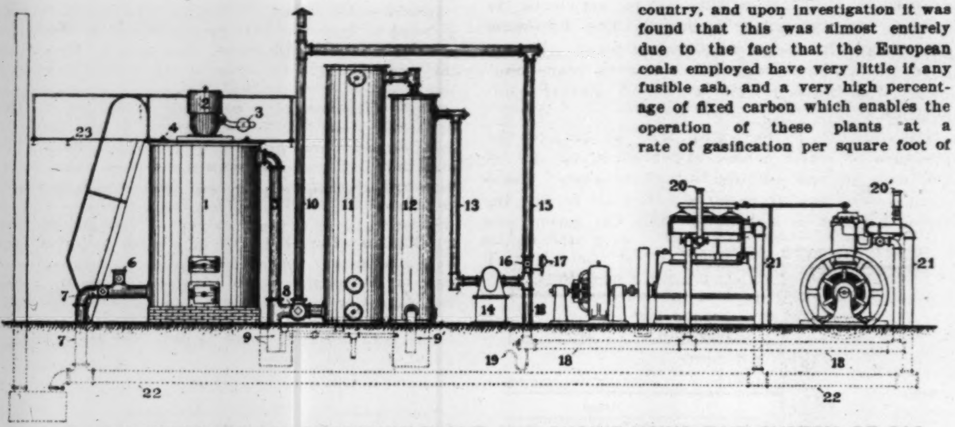

FIG. 1. ELEVATION OF GAS PRODUCER PLANT AND ENGINE USING TAIT SYSTEM OF GAS GENERATION.

1 Gas Generator
2 Coal Hopper
3 Automatic Gas-tight Hopper Valve.
4 Poke Holes
5 Gas Outlet Pipe
6 Air Inlet Pipe and Valve.
7 Exhaust Inlet Pipe Valve
8 Three-Way Automatic Gas Valve
9, 9^1 Safety Release Water Seals
10 Purge Pipe
11 Scrubber
12 Dryer or Purifier
13 Gas Outlet Pipe
14 Automatic Exhauster and Gas Regulator
15 By-Pass Connection to Purge Pipe 10
16 Valve
17 Testing Burner
18 Main Gas Pipe to Engine
19 Water Trap
20 Air Inlet Pipes on Engine
21 Gas Inlet Pipes to Engine
22 Exhaust Main
23 Iron Working Platform

Producers may be divided into three classes; the up-draft pressure producer, the up-draft suction producer, and the down-draft producer, either suction or pressure, to which may also be added a combination of these types especially designed for bituminous fuel, in which both the up and down drafts are either used alternately or in combination for the purpose of fixing the volatile hydro-carbons encountered when using this type of fuel.

The up-draft pressure producer, which is perhaps the oldest and most familiar type, is well known in its application for supplying a fuel gas for furnaces. This producer is usually used by steel works, glass works, and other industries requiring large volumes of fuel gas for direct burning, and consists essentially of a vertical chamber lined with refractory material, the lower end of which is immersed in a water pan, so that the water contained therein forms a liquid seal, which prevents the escape of gas at that point. This type of producer is generally designed without any form of grate (although the use of a grate does not affect the principle), a pile of ashes in the lower part supporting the fuel bed, and the draft being supplied through a central tuyere to the fuel.

This blast usually consists of a mixture of steam and air under pressure, which is obtained by means of a steam jet blower, and the gas so obtained, consists of a mixture of H, CO, CO_2, N and CH_4, the amount of the latter depending upon the nature of the fuel employed.

The gas thus generated, while answering all the requirements of the furnace is, due to its uncertain and varying composition, somewhat difficult to utilize for the operation of gas engines, for the reasons that will be noted later.

The suction producer is practically the same apparatus, although usually supplied with a grate, instead of a water seal, and has its draft induced instead of forced, as in the former type. This style of producer has so far been used successfully for power purposes, the engine itself usually supplies the necessary suction, and by means of steam or water vapor regulating apparatus, a fairly uniform quality of gas is obtained.

The third type, or down-draft producer consists in a reverse of the foregoing, the draft being admitted above the bed from the same orifice or similar orifices as those used for supplying fuel, the object being the fixation of the volatile hydro-carbons contained in the fuel employed, by causing them to pass off through the incandescent bed of fuel in the producer.

To these types may be added various arrangements of the foregoing in which combinations of up and down drafts are utilized for the double purpose of keeping the fuel beds in a well broken up condition, and for the purpose of generating special qualities of gas, such as "alternate" water gas and air gas.

Unfortunately the utilization of these plants in this country has been attended with considerable difficulty, due to the unsatisfactory nature of American fuels, high in fusible ash.

To explain this point, it will be noted that the producer business in Europe has reached a very much more advanced stage than in this country, and upon investigation it was found that this was almost entirely due to the fact that the European coals employed have very little if any fusible ash, and a very high percentage of fixed carbon which enables the operation of these plants at a rate of gasification per square foot of inside diameter entirely out of the question in this country, as the temperatures so obtained would fuse our ashes into a regular slag.

But for the question of fusible ash, it would be very much more advantageous, as has been found in Europe, to operate producers at a high rate of gasification, as by so doing, the temperature of the complete combustion zone may be maintained well above 2,000° F., with the result that all steam fed to the producer, even at fairly low loads, will become dissociated, and will supply a hydrogen constituent to the gas, directly proportionate to the amount of steam fed into the producer. This being the case, it was only necessary to design a steam or water vapor regulating apparatus of a sufficiently automatic nature to take care of all variations in load, to enable the plant to generate a gas containing a fairly uniform amount of hydrogen.

However, all attempts to obtain the same results in this country have failed, for the reason that in order to obviate trouble from clinker, due to the high percentage of fusible ash in American fuels, it was found necessary to make the grate surface very much larger per horsepower than was the case in foreign practice, and while this change practically obviated clinker troubles, we found ourselves confronted with an even worse difficulty, due to the fact that on half or quarter load, the temperature of the combustion zone in the producer was very much below the point necessary for complete dissociation of the steam supply for the producer. This gave us a gas which from 5,000 or more analyses which the writer has made, showed considerable variation, the hydrogen constituent varying anywhere from 5 to 20% by volume of the gas generated according to the temperature of the combustion zone in the producer, which in turn was absolutely controlled by the amount of load on the plant.

Of course these defects were not recognized immediately, and it took several years of practical experience to demonstrate that it was a physical impossibility to generate a producer gas under European methods in America and to have the hydrogen constituent of the same remain uniform at varying loads.

While this variation in the hydrogen constituent was of comparatively little moment, when the operation of furnaces with gas was considered, on the other hand it produced a very serious defect when using this gas for the operation of engines. Not so much for the reason that the total British thermal units changed, because such change was slight, and should have been handled by the governors on the engine, but that as hydrogen burns approximately twice as rapidly in an engine cylinder as carbon monoxide, and as the ignition point was usually set to conform with the ignition period of the more rapidly burning constituent hydrogen, it followed that when this constituent fell off in quantity, that the engine would be firing at too late a period of the stroke to be economical, in addition to the fact that the late fire caused excessive heating of the exhaust valves.

Having obtained this information the writer then set about to obtain if possible some other means of producer operation, so as to eliminate the most changeable constituent of the gas, namely hydrogen, having by this time become thoroughly convinced that it was more essential that an engine should have for its operation a gas with an absolutely fixed ignition point, than it was to supply that engine with a gas of high heat value, and having come to this conclusion, a series of experiments were made with a view to determining if possible a remedy for the difficulty.

A producer was equipped with a draft supply consisting of pure air alone, and yielded a gas consisting essentially of carbon monoxid and nitrogen, with only a slight percentage of hydrogen corresponding to the hydrogen constituent of the fuel employed.

This gas had a British thermal unit value of about 105, which was of course very much lower than would have been the case had the usual steam saturated draft been employed.

On the other hand, although having a lower heating value, the fixed ignition point of the gas and its uniformity of composition was very striking, and but for the fact that the producer, in the absence of any draft diluent became overheated to such a degree as to cause clinkers from the fusible ash in the coal, very satisfactory results would have been obtained.

This gas was washed and scrubbed in the usual manner, and used for the operation of a 100-HP. three-cylinder-vertical-engine of well known make, and the remarkable fact was noted that this engine, which had formerly given great trouble from premature ignitions at certain loads while operating on regular producer gas, in this case operated with complete smoothness, and what was perhaps more surprising still, by an advance of the igniters to the correct position, it developed horsepower slightly in excess of its builder's rating.

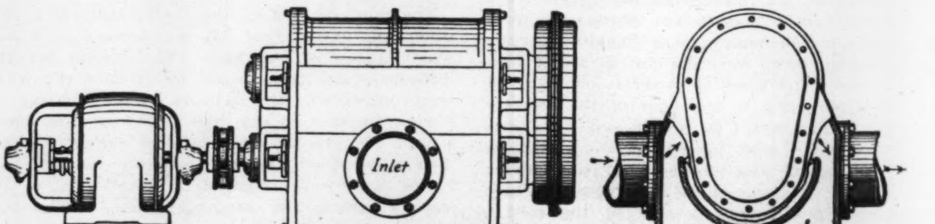

FIG. 2. SIDE ELEVATION AND CROSS SECTION OF AUTOMATIC GAS PRESSURE REGULATOR FOR USE WITH TAIT SYSTEM.

This apparent increase of power, however, was undoubtedly due to the fact that with this very uniform gas, which had a fixed high limit, it was possible to set the ignition at exactly the correct point, which point remained absolutely constant, barring changes due to the action of the throttling governor under load variations.

After making a short run under these conditions, it was found possible by increasing the compression of the engine to 200 lbs., combined with setting the igniters at tly the right point, to carry about 15% more power the engine than the builders cared to guarantee. In r words, it was obvious that the builders of producer ngines, knowing the variable quality of the ordinary ucer gas upon which their engines have to operate, very conservative in their engine ratings, as they to be, in order to be on the safe side when the tion point in the gas changes.

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*A paper presented before the Gas Power Section of The American Society of Mechanical Engineers at the Detroit Meeting.

†Manager Gas Power Co., 2 Rector St., New York.

his and other similar experiments proved that the essential feature in a power gas is its uniformity omposition, which in turn means its fixed ignition and that no matter how low the British thermal s within reasonable limits, it is perfectly possible operate the gas engine successfully, provided that the ion point always remains the same, it being obvious the throttling governor on the engine would merely wider for the leaner gas and take in more gas stroke.

After settling this fact thoroughly by continued experi-nts, the writer then looked about for some means of oling the fire to take the place of the usual steam turated draft, and finally decided that the use of rbon dioxide in fixed amounts might answer the pur-pose.

The exhaust from the engine was piped back with a by-pass to a mixing valve on the producer, so arranged that part air and part exhaust could be admitted to the ash pit. With a proper mixture of exhaust and free air the producer could be operated at a sufficiently high temperature to make gas, while at the same time, low enough to obviate any dangers of clinkers of the fusible ash.

Reference to Fig. 1 will show an elevation of a complete producer and engine plant of this kind which was installed in Brooklyn about 18 months ago. The plant consists of (1) a gas producer of the suction type equipped with the usual type of coal feeding hopper but having no evaporator or other vapor supply; this producer is supplied with the usual down-take pipe (5) communicating with a two-way valve (8) for throwing the purge pipe into operation when the plant is shut down, scrubber (11), purifier (12) and gas pipe (13), which in this case delivers gas to the automatic exhauster (14), a piece of apparatus which will be described later. From here the gas flows through pipe (18) to the two engines shown. The exhaust from these engines passes off through pipes (21) and (21′) to the exhaust main (22), which leaves the building at a point under the producer and is by-passed through pipe (7) up to the mixing valves (6) and (7), where air and exhaust gases enter the base of the producer.

The apparatus (14) of which a cut is also shown in Fig. 2 consists of a postive type exhauster operated by motor or other suitable means, and which draws the gas from the producer as indicated by the arrow points, and discharges the same toward the engines and at a predetermined and absolutely fixed pressure.

This pressure regulation is very simply obtained, by the fact that the outlet of the exhauster communicates through several pipes, as shown in the drawing, to a seal of water contained in the base of the apparatus, this seal of water being set to the desired point to give best results at the engines. Any excess gas over and above this pressure naturally bubbles up through this water seal, returning to the inlet side of the exhauster. This apparatus in a very simple manner takes the place of the usual gas holder and enables engines to be operated in parallel from the same suction producer.

This apparatus is not an essential part of the experiment above alluded to, but it was found to greatly assist in steadying up the conditions upon which the plant operated and was absolutely necessary to close regulation when it was desired to operate more than one engine from a single suction producer.

The plant of which Fig. 1 is an illustration has now operated for about 18 months, part of the time 24 hours per day, six days a week and at loads varying from one-quarter to 10% above builders' rating, and has during that entire period given no trouble from variations in the quality of the gas, such as would have been encountered, had this gas been generated in the usual manner and containing the usual fluctuating amount of hydrogen.

Furthermore it was ascertained in practice that the exhaust pressure in the ash pit was just sufficient to offset the suction caused by the gas being drawn off the producer, with the result that the poke-holes on top of the producer could be opened and kept open without any gas escaping or any air getting into the producer, and for this same reason it was found possible to open the ash pit and grate bar doors wide and to clean the fires thoroughly while the full load was on the engines, without in any way interfering with the quality of the gas. This latter point proved to be a very satisfactory one with the operators of the plant, as it enabled them to clean their fires while the daily run was going on and no overtime had to be charged to this operation. Also the pulsation of the exhaust gave a very beneficial shaking action upon the fuel bed in the producer and seems to entirely obviate the tendency for fissures to form in the fuel bed, with the result that the average carbon dioxid obtained in the producer gas made under this arrangement is only 1½%, which, compared with the average obtained under the old method of producer operation, shows a very great saving.

While from a thermal standpoint it is a doubtful question whether the producer itself is as efficient a converter of heat values, under this system, as when using a steam saturated draft under test conditions, it has been found in actual practice that the fuel saving on the plant is considerable, due to the fact that the entire absence of necessity for rebuilding the fire at any time and the ability to operate continuously, naturally conserved the fuel consumption to a remarkable degree. In fact, the actual coal consumption on this plant, taken for a period of six months, and including all standby losses, showed that the plant is burning 1¼ lbs. of coal per B. HP.-hr., while the load factor was less than two-thirds, and the working day but ten hours, while Sundays the plant was shut down. Further, when the occasion arose to operate this producer 24 hours per day at full load, it was found that the coal consumption was 0.7 lb. per B.-HP. developed during time of operation, and that this economy could be maintained for as long a period as the load conditions allowed.

For operation on anthracite fuels, the up-draft suction producer shows by long odds the best economy, as it eliminates all leakages of gas while operating, which losses, in addition to the heat value thrown away, mitigate greatly against the plant by annoyances to the operators from the gas poisoning entailed, it being a physical impossibility for the operator of a producer plant to do justice to his work when suffering from a splitting headache, such as is too often the case with men employed around pressure producer plants.

The suction producer, on the other hand, is extremely simple of operation and does not pollute the air of the producer room to any noticeable extent, with the result that the operators take a great interest in the plant and a pride in keeping it up to the best possible working condition. This is a point to which owners of producer plants have hitherto given very little attention and which seems to the writer to have a necessarily vital effect on the success of the enterprise.

Some difficulty has been found in using a suction producer where a very fine coal, such as No. 2 buckwheat, is employed, due to the difficulty of pulling the draft through the heavy fuel bed, but the writer has found this to be merely a question of grate design and draft distribution, and one which can be easily taken care of, if the engineer laying out the plant gives the matter its merited attention.

As to operation on bituminous fuel, the up-draft producer is very much easier to handle than the down-draft, but it of course involves the use of some form of tar washer to take care of the by-products left in the gas after they leave the scrubber, and as these by-products sometimes represent a considerable percentage of the heating value of the fuel employed, this type of plant is open to objections.

The down-draft producer, on the other hand, while it "fixes" the gas to quite a considerable extent, is subject to the tremendous disadvantage that the fine particles of ash form in the upper zone and passing downward in the fuel bed with the draft, tend to clog up the entire fuel bed, so that it is impossibe to operate this type of plant for any considerable period without breaking up the fuel bed, either mechanically, or by means of a reverse blast of considerable pressure, either operation necessitating a change of conditions and gas output, calling for the installation of a duplicate unit or a large gas holder to steady the output during these periods.

It seems to the writer that the ideal way out of the difficulty would be to use a gas producer combining the merits of both, as far as possible, and this might be obtained by using an up-draft producer in which the outlet gas pipe protruded into the fuel bed down to within, say, 3 ft. of the grate, and the space above the end of this pipe up to the top of the producer being filled with fuel.

Some such arrangement as this was tried by the writer, with the result that a gas very high in CH_4 was obtained, due to the fact that the upper half of the producer acted as a destructive distillation retort, while the lower part was only called upon to operate on the coked fuel.

There is of course nothing original in this idea, it having been tried in Europe in several instances, but it would seem that some such arrangement, in conjunction with a mechanical tar separator of small dimensions, would be found to go a long way toward handling bituminous fuel satisfactorily.

In conclusion the writer has the pleasure to report that the gas producer business is now advanced so far toward a successful conclusion, that absolute uniformity, reliability and continuity of operation can now be guaranteed and supplied, while at the same time, the very attractive economies always claimed for producer plants still remain, and barring the possible high first cost of the installation, there is no longer any reason why this type of power plant should not meet with all the requirements of the manufacturing industries.

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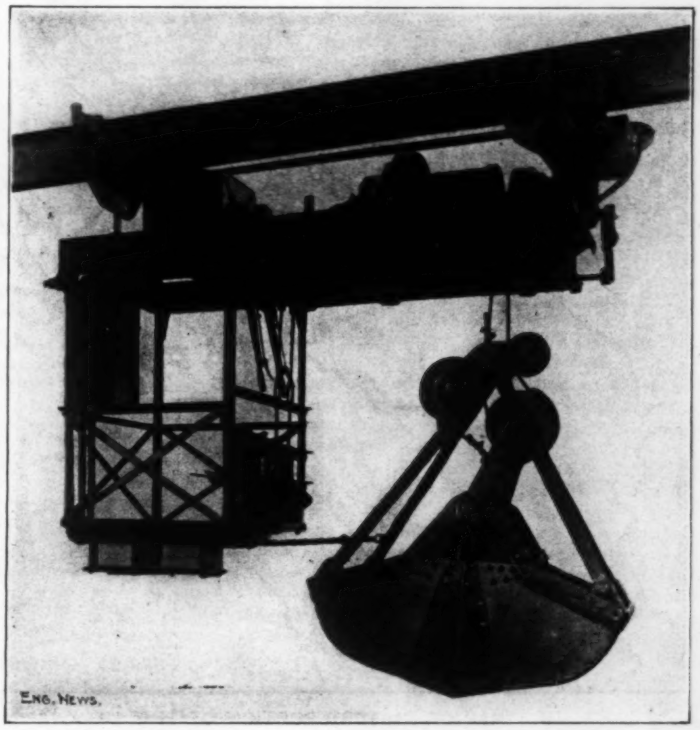
AN ELECTRIC TRAVELING HOIST WITH GRAB BUCKET.

The traveling hoist shown in the accompanying figure is provided with swivel trucks for short-radius curves and is in many ways a common type. The equipment with a two-line grab bucket, however, is of interest to users of such hoists. The hoisting and holding cables are wound by one motor through friction clutches operated from the cage. The lowering, opening and closing of the bucket are all by gravity. When the bucket has reached its highest point it is held by a friction brake. The friction clutches used in hoisting are designed to slip at a certain overload. The intermediate hoisting shaft is extended to the rear of the operator's cage and there carries a drum which is given about twice the peripheral speed of the hoisting drums. This auxiliary drum winds a rope which extends under the cage to the grab bucket and steadies it. The steadying rope is kept taut, without overstrain, at all times, by driving the auxiliary drum with friction disks keyed to the shaft and held against the drum by spiral springs made adjustable for wear and changed requirements in the rope tension. Normally they would be adjusted to cause the drum to put a load of 250 to 300 lbs. on the steady rope.



AN ELECTRIC TRAVELLING HOIST WITH GRAB BUCKET.
(Built by the Cleveland Crane and Car Co., Wickliffe, Ohio.)

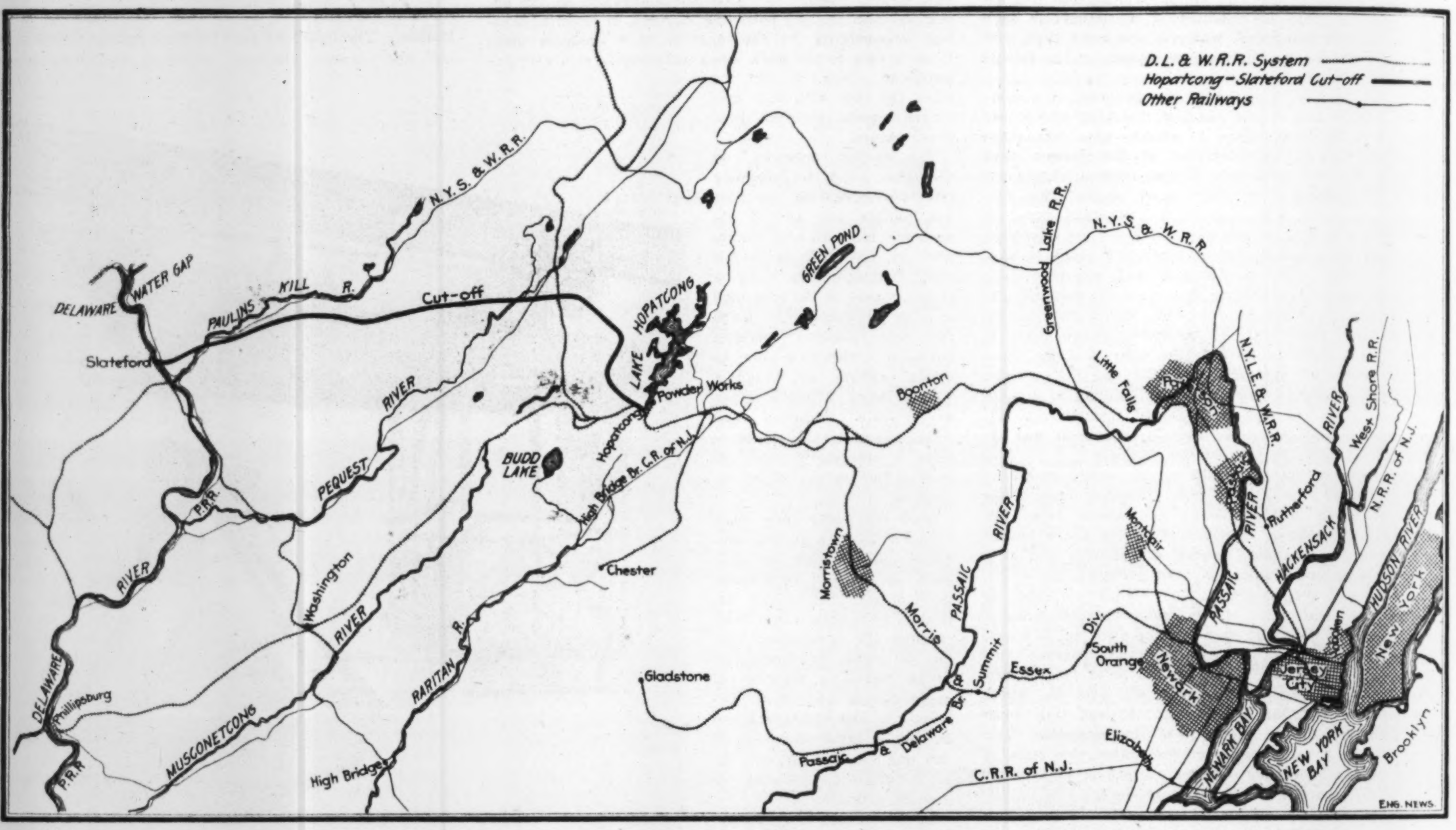
The driving truck carries an electric motor the speed of which is varied by the drum controller in the cage. In ordinary practice in coaling plants the track speed of the hoist is from 300 to 500 ft. per min., although this can be changed. This hoist was designed and built by the Cleveland Crane & Car Co., of Wickliffe, Ohio.

THE NEW CUT-OFF LINE OF THE LACKAWANNA RAILROAD.

By F. L. WHEATON.*

The Delaware, Lackawanna & Western R. R. was at its inception a coal-carrying road built to transport its coal from the mines to the eastern markets, and when in the early fifties it began to extend its line eastward it was like other roads of that day, lacking in financial strength. As the country through which it necessarily had to build was at best exceedingly rugged and mountainous, its management was compelled to extend it along the line of least resistance at some points, rather than by the most direct route toward the coast. The road was, therefore, built from Scranton southeast over the Pococo Mountains and through the Delaware Water Gap to a point on the Delaware River near Portland, Pa., by the parent company, and from the Delaware River southeast to Hampton by a leasing line, the Warren Co. R. R. Co.

The drainage of all northwestern New Jersey flows southwesterly into the Delaware River, and the watersheds are high and rocky in the north, decreasing gradually in height toward the south, until comparatively low and level land is reached. This formation necessitated the construction of two tunnels on the line of the Warren County R. R.; one at Manonka Chunk, 975 ft. in length, and other at Oxford, 2,996 ft. in length.



MAP OF EASTERN PORTION OF THE DELAWARE, LACKAWANNA & WESTERN R. R. SHOWING LOCATION OF THE HOPATCONG-SLATEFORD CUT-OFF

At Hampton the D., L. & W. R. R. Co., lessee of the Warren County R. R., delivered the greater part of its coal to the Central R. R. of New Jersey for transportation to tide water, and at Washington, N. J., a portion was transferred to the Morris Canal, then in the height of its usefulness and prosperity, for transportation to Boonton, Paterson, Newark and other towns along the line of the canal. The construction of the road to Hampton by way of the Delaware Water Gap and Washington was therefore no mistake at that time, as it served the needs of those early days at the least expense for construction.

At Washington the Warren Co. R. R. crossed the line of the old Morris & Essex R. R., extending from Hoboken to Phillipsburg, on the Delaware River. This road was later leased by the D., L. & W. R. R., and in this way the latter company obtained a through line from the coal fields of Pennsylvania to tidewater at New York.

There is but one point where a railroad east from Scranton can pass the barrier imposed by the rugged range of the Kittatinny Mountain, and that is at the famous Delaware Water Gap, where in past ages the Delaware River cut its way through this range. It is, therefore, impossible to materially shorten the line between Scranton and Water Gap, but east of that point the present line makes a wide detour to the south by way of Washington, and then back toward the north through Hackettstown to Lake Hopatcong. Until recently it has been regarded as impracticable to build a more direct line between the Water Gap and Hopatcong, as the route would necessarily cross the watersheds diagonally and at points where the divides are high and rocky and the valleys deep, but, on account of the distance and heavy grades and curvature by the present line between these points, the management of the railroad has been led to seek a shorter route and one having lighter grades and fewer curves, over which the heavy traffic of its eastern division can be more economically handled. The general layout of the eastern end of the line is shown in the accompanying map.

Three lines extending from various points east of the Delaware River to points west of Waterloo on the present main line had been surveyed previous to the year 1902 with this end in view, but, while shortening the distance about eight miles, these lines were not satisfactory, as they left a stretch of five miles of pusher grade and bad alinement against eastbound traffic between Waterloo and Lake Hopatcong. In the year 1905 Mr. L. Bush, Chief Engineer of the road, projected several lines, the results of which showed it to be possible, although at large expense, to construct a line from a point below the Water Gap to Lake Hopatcong, which would fulfill all requirements; viz., shorten the distance very largely, and at the same time reduce materially the grades and curvature and eliminate the tunnels. On Dec. 1, 1905, a party was placed in the field and a preliminary line run between Slateford, a small village on the west bank of the Delaware River just below the Water Gap, through the county of Northampton, Pa., Warren, Sussex and Morris Counties, N. J., to a point about one-fourth of a mile west of Landing station at Lake Hopatcong. This survey showed that a line could be built, having a maximum equated grade of 0.55% equal to 29.04 ft. per mi., saving over 11 miles in distance, cutting out a very large amount of curvature and eliminating tunnels. A final location was then made substantially on this preliminary line, including contour maps, profiles and estimates of cost.

A tabulated statement is given on the next page showing a comparison of the physical features of the old and the new line between connecting points.

The new cut-off line will reduce the distance between New York City and Buffalo from 411 miles to less than 400 miles, which amounts to a reduction of over 2½% of the total distance.

In order to determine whether the annual saving in the cost of operation and maintenance would justify so large an expenditure as the preliminary estimate indicated, a statement was made showing what the annual saving would be, based on the actual cost of operation, maintenance of roadway, structures and signals, repairs to rolling stock, engine service, etc., for the year 1905. This cost was then reduced to cost per train mile and the annual saving in each item computed for the saving in distance, grade, curvature, rise and fall, etc., as shown in the foregoing table. The total cost of operation was found to be approximately 57 cts. per train mile and the annual saving by the construction of the new line showed that an expenditure largely in excess of the estimated cost of its construction would be warranted.

In making up the statement of annual saving many items were necessarily omitted for the reason that they could not be reduced to dollars and cents, as, for instance, the saving of approximately twenty minutes in running time of every passenger train over the new line and one hour in the time of every freight train, resulting in a corresponding increase in the earning capacity of every engine and car in the service, and a reduction in per diem charges paid for foreign equipment. Another item of saving will be a decrease in the liability of damage to equipment by rea-

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*Engineer of Construction, D. L. & W. R. R., Hoboken, N. J.

TABLE SHOWING COMPARISON OF OLD AND NEW LINE BETWEEN SLATEFORD, PA., AND HOPATCONG, N. J.

	Old line.	New line.	Saving.
Distance	39.57 mi.	28.45 mi.	11.12 mi.
Maximum grade	1.14% = 60.2 ft. per mi.	.55% = 29.04 ft. per mi.	31.16 ft. per mi.
Curvature-central angle	1,999°	439°	1,560°
Number of curves	57	15	42
Maximum curve	6° 54′ with a large number of 5° curves.	one max. curve 3° 30′.	3° 24′
Length of curved line	12.98 mi.	4.88 mi.	8.1 mi.
Percentage of tangent	67.2%	82.8%	15.6%
Rise and fall	248 ft.	11 ft.	237 ft.
Length of tunnels	3,971 lin. ft.	00	3,971 lin. ft.

of derailments which, other things being equal, is in direct proportion to length of line, but in this case should show a much greater proportional decrease owing to the reduction in gradient, curvature and rise and fall.

The new line as located leaves the present main line at Slateford, three miles below the Water Gap station, curves to the right on a 2° curve for a distance of 900 ft. and then continues on an ascending east bound grade of 0.55% along the side of the bluff on the west side of the river to a point about three-quarters of a mile south of the starting point where it swings to the east on a 3° 30′ curve, the only curve on the line exceeding 2°, and crosses over the present main line and the Delaware River to the Jersey shore. The new line then runs almost directly east along the south slope of the beautiful Pauline Kill valley to a point near Johnsonburg, where it crosses the divide between the Pauline Kill and Pequest rivers. The distance from Slateford to this point is 12 miles in which distance a height of 337 ft. above the present main line at Slateford is attained, amounting to an average grade of 28 ft. per mile for the entire distance. Allowing for compensation for curvature this is practically the maximum grade established. From this point eastward to the Pequest River, a distance of 6 miles, the line will traverse a high rolling table land broken by high ridges of limestone thrown up by volcanic action. Over this stretch the grade is practically level except for a very slight rise and fall of 5 ft. adopted for drainage purposes. From the Pequest River eastward to Hopatcong the gradient is the maximum of 29.04 ft. per mile compensated for curvature.

When the line leaves the bluff on the west bank of the Pequest it will continue on a tangent eastward across the Pequest valley for three miles on what is said to be the largest railroad embankment in America if not in the world. This embankment will be from 75 to 110 ft. in height and will contain 6,625,650 cu. yds. of material. From Kerrs corners near Johnsonburg to the mountain east of Andover, a distance of 10¾ miles, there is only one 30′ curve, having but 6° 30′ central angle.

At a point about one-half mile east of Andover the line will curve to the south crossing through the divide between the Pequest and Musconetong watersheds in a rock cut a half-mile in length. From this cut will be removed 544,000 cu. yds. of New Jersey granite. The line will then cross the valley of the Lubber Run Creek on an embankment containing 1,100,000 cu. yds. and continuing south and southeast along the westerly slope of the Walkill Mountains will join the present main line again one-quarter of a mile west of Hopatcong station.

On the new line there will be no grade crossings of either railways or highways, which together with the water courses crossed will necessitate the construction of 65 concrete structures varying in span from 4 ft. to 150 ft. The most important of these structures are the arch bridge over the Delaware River, between Portland and Slateford, Pa., the one over the Pauline Kill, the New York, Susquehanna and Western R. R., and a highway near Hainesburg, N. J., and the 70-ft. arch over the Pequest River, about one mile west of Huntsville. The Delaware River bridge crossing will consist of five 150-ft. concrete arch spans, two 120-ft. arch spans and two 30-ft. arch spans, the latter over the present main line tracks, and a highway on the Pennsylvania shore. This structure will be approximately 1,450 ft. in length, and its height from ordinary high water in the river to the base of rail will be 65 ft. The track system is supported by spandrel arches, resting on the main arch rings.

The Paulins Kill bridge will be approximately 1,100 ft. in length and will be about 115 ft. in height from water level in the river to base of rail. This structure will consist of five 120-ft. concrete arch spans and two 100-ft. arch spans, and the track will be supported by spandrel arches resting upon the main arch rings in the same manner as in the Delaware River bridge. The abutments of both structures are of the U-type, but those of the Paulins Kill are designed with three longitudinal reinforced-concrete walls supporting a reinforced-concrete slab carrying the tracks and ballast, allowing the embankment to take its natural slope between the walls as well as on the outside of them, and thus balance the earth pressure and avoid the heavy section necessary had they been designed as retaining walls.

In the specifications for grading only two classifications were provided, viz.: earth excavation and rock excavation, with no overhaul.

To aid the contractors in making up their bids, a profile was furnished them showing the approximate quantities in each cut and fill, the approximate proportions of earth and rock that would be encountered and the disposition of excavated materials showing approximate average distance of hauls from each cut.

In the specifications for concrete three classes of concrete were provided for, of the following proportions:

Class "A" 1 cement, 2 sand, 4 broken stone.
Class "B" 1 cement, 3 sand, 5 broken stone.
Class "C" same as class "B" with large quarry stone bedded in concrete.

Class "A" concrete is to be used in copings and ornamental railings, Class "C" in foundations below ground line and in massive abutments and piers for arches below the springing line, and Class "B" in all other cases.

The total estimated quantities of earth and rock excavation and concrete are as follows:

Earth excavation	8,861,000	cu. yds.
Rock excavation	4,320,000	" "
Embankment	14,621,100	" "
Concrete (all classes)	225,500	" "

The contracts for the work were awarded in seven sections, each contract including all clearing, grading, masonry, etc., on the section.

Following is a list of the successful bidders on the several sections:

Sec. 1. Timothy Burke, Scranton, Pa.
Sec. 2. Waltz & Reece Construction Co., Billings, Mont.
Sec. 3. David W. Flickwir, Terry Bldg., Roanoke, Va.
Sec. 4. W. H. Gahagan, 189 Montague St., Brooklyn, N. Y.
Sec. 5. Hyde-McFarlin Co., 7 East 42d St., New York City.
Sec. 6. Reiter, Curtis & Hill, Arcade Bldg., Philadelphia, Pa.
Sec. 7. Smith & McCormick Co., Easton, Pa.

Actual work was begun Aug. 1, 1908, and is to be completed on or before Aug. 1, 1911.

All the work has been done under the supervision of Mr. Lincoln Bush, M. Am. Soc. C. E., Chief Engineer of the D., L. & W. R. R. Co., assisted by the writer, who located the line and will have charge of construction, and B. H. Davis, Assistant Engineer in charge of masonry design.

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AN INTERESTING RAILWAY will be opened in Moscow, Russia, in the near future. The line forms an irregular oval round Moscow at various distances from the city barriers. It intersects all nine of the Moscow railway lines, and will be used for transferring freight from one line to another, thereby saving cartage and also considerably relieving the congested state of the streets of Moscow. It will also tap a whole series of factories which have hitherto been off any line.

TESTING STEEL TAPES AT THE NATIONAL BUREAU OF STANDARDS.

By HERBERT T. WADE.[*]

One of the most important functions of the National Bureau of Standards at Washington, D. C., is the testing and standardization of steel tapes of various lengths and forms used in engineering work. These tests range from the minute and critical examination and study of the steel and invar tapes of the U. S. Coast & Geodetic Survey employed in the accurate measurement of base-lines to the inspection of the ordinary steel tapes of the surveyor and engineer. All of these tests are carried on in a specially designed laboratory, which is, without doubt, the best equipped for this kind of work of any testing bureau or physical laboratory in the world. In fact it can be only compared with a somewhat similar room of less than half the length at the International Bureau of Weights and Measures at Sevrès near Paris. Both of these laboratories are located underground in order to secure a constancy of temperature, but the Washington testing room not only is better designed and equipped, but already its constants are known with a high degree of precision.

It is installed in the tunnel connecting the physical laboratory and the mechanical building of the National Bureau of Standards. It is about 8 ft. below the surface of the ground and is separated from a passageway used for pipes, electric conductors, and general service between the two buildings by a masonry wall. The room thus formed is about 171 ft. in length, and is about 8.2 ft. in width and height. It is lined with white enamel brick, lighted by electricity, and contains steam and brine coils in addition to ventilation inlets and outlets, so that by the aid of thermostats the temperature can be controlled within narrow limits.

On one side against the wall is the United States Bench Standard of length, which consists of a steel bar, mounted on rollers and supported horizontally on brackets. Opposite this standard is the comparator proper used for the determination and standardization of steel and invar tapes for base-line measurement and also for standardization of base bars of 5 meters in length from the national prototype meter standard.

The floor of the room is of concrete on which is laid a track for the carriage containing the ice trough in which the bar used as a standard is carried when measurements and comparisons are being made. There are eleven stone piers spaced 16.4 ft. apart, and on these are mounted the micrometer-microscopes. Each pier is 14 × 14 ins. in cross section and is set on a concrete base 16 ins. square and 18 ins. deep, the base of the piers being separated from the floor by a space of 2 ins. This makes the piers and their foundations entirely independent of the floors or the structural walls of the building. At the north end of the tunnel the base of the terminal pier was built through a small vault to solid ground beneath and is about 8 ft. in height and 6 ft. square. The piers at the ends carry not only the micrometers but also the marking bolts identifying the beginning and end of the standard distance.

The tunnel thus arranged affords a comparator 50 meters (164 ft.) in length, which is sufficient for the long tapes used in geodetic surveying. It might be said in passing that the development of the accurate use of tapes in the measurement of base-lines has been a striking feature of the work of the U. S. Coast & Geodetic Survey in recent years, and such precision has been attained in the use of these tapes for measurements of base-lines that they seem destined to supplant the more cumbersome base-bars.

Within a few years invar tapes, made from an alloy of steel and nickel discovered by M. Ch. Ed. Guillaume, of the International Bureau of Weights and Measures, have been thoroughly tested in the field after standardization in the laboratory, and the accuracy and convenience of their use has been clearly demonstrated. In

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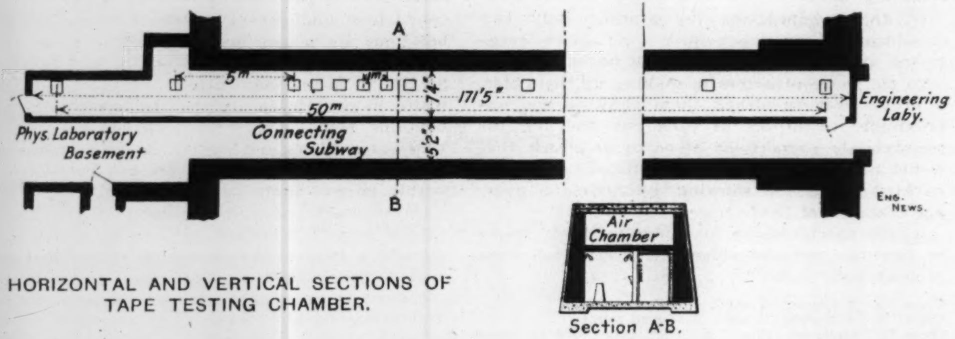
[*] 149 East 46th St., New York City.

Europe M. Guillaume has carried on similar work, but with wires instead of tapes, and he as well as other European engineers and geodesists have used invar standards for base-line measurements with great success.

In using the comparator, the first step is to standardize a 5-meter steel or other bar in terms of the U. S. National Prototype Standard, which is a meter bar of platinum-iridium made at the International Bureau of Weights and Measures at Sevrès, and like the other similar national standards of length of the nations of the world known most accurately in terms of the International Prototype Meter preserved at the Bureau. To transfer the meter to the 5-meter bar there are in the third interval of five meters between the piers, measuring from the south end of the tunnel, four similar and intermediate piers spaced a meter apart. These piers are of similar size and construction to the others and on them the micrometer-microscopes can be placed so that the meter bar passed successively over the intervening five meter distances will give a standard distance of five meters with which the five meter standard may be compared. The micrometer-microscopes are placed on iron brackets or arms which are attached firmly but in an adjustable manner to the tops of the stone piers, each of the latter having a hole cut through its top below the microscope arm so that light from an incandescent lamp hung back of the pier can be used for the illumination of the microscope and bar.



HORIZONTAL AND VERTICAL SECTIONS OF TAPE TESTING CHAMBER.

The micrometer-microscopes used in the standardization work of the Bureau have been tested for many years by the Division of Weights and Measures of the Bureau of Standards and previous to its establishment by the Office of Standard Weights and Measures of the Coast Survey, so that the constants and operation of these instruments are known thoroughly, though the usual adjustment is for one division on the head of the micrometer to correspond to one micron on the bar. The standard meter is placed in shaved ice in a trough mounted on two trucks. This trough can be raised or lowered by simple and exact adjustments, and in fact the bar in the trough may be adjusted under the microscopes to a micron, or one-thousandth of a millimeter. The standard meter is placed under one of the microscopes at the beginning or end of the five meter interval and the cross hairs are set with great precision on the fiducial line marking the limit of the standard distance. Then the second microscope and its cross hairs are set on the line at the opposite end of the bar with similar accuracy. The bar on the supporting carriage is then moved along between the second and third piers and similar adjustments are made. In this way the standard length of five meters is obtained and the value of the five meter bar which then can take the place of the standard meter in the ice trough is obtained. The value of the meter at the temperature of melting ice, 0° Centigrade, is accurately known, and this temperature figures as a standard in all metric determinations.

With a five meter standard accurately determined it is possible to measure successively the ten intervals of the 50 meter base of the tunnel, the process being precisely similar to that followed in getting the value of the 5-meter bar.

Not only must the temperature of the bars in the ice trough be known and regulated but the temperature of the tunnel itself and of the tapes under test. For this purpose there are carried on the walls of the room 14 lines of pipe, the upper twelve of which are used for circulating brine cooled to a temperature of — 10° centigrade and enabling the temperature of the room to be reduced to 0° centigrade with facility. The two lower lines of pipe contain steam when desired, so that not only can the coefficients of expansion of the tapes be measured but the temperatures of ordinary field work duplicated. This, of course, does not obviate the necessity of taking exact thermometer readings at each observation and determination, and these are made as usual with carefully calibrated thermometers.

The microscopes at the ends of the 50-meter comparator, to which reference has been made, are referred to the bronze bolts in the pier foundation to insure their greater stability. Having the distance between the two terminal microscopes accurately determined with the ice bar apparatus it is only necessary to substitute the steel or invar tapes and to apply the standard tension with spring balances which previously have been calibrated with correct weights in another laboratory of the Bureau. The tapes can be supported at such intervals as would be employed in field work and by the temperature regulating apparatus already described, the temperature of the vault can be varied and the coefficients of expansion can be determined with great precision.

In making the standard tests, measurements are made with the ice bar apparatus in the morning and then again at night, and the mean of the two measurements is the standard distance for the day. The tapes ordinarily are measured after they have remained all night in the laboratory comparator room and have assumed its temperature.

In recent tests of invar tapes the coefficient of expansion of tapes of 50 meters in length was determined with precision to a micron, and was found to range from .000,000,374 to .000,000,44 for 1° centrigrade. Thus invar has a coefficient of expansion of about 1/28 that of steel, so that working under ordinary conditions where the refinements of the most precise geodetic work are not necessary, a temperature correction can be neglected. The determination of the expansion of the invar and steel tapes involved a study of the constants of the comparator room itself, and it was found that the entire tunnel shrinks about six-hundredths of an inch in passing from a temperature of 100° F. to 32° F.

The work in the laboratory is so arranged that there can be measurements made each day, and there is a direct comparison of the tapes with the five meter bar on each occasion. This bar, which has been used for many years, so that its constants are known with high precision, is of steel, with the terminals of the standard distance indicated by lines on platinum-iridium plugs. In testing invar tapes the tension used is 10 kilograms, while ordinary steel tapes of 100 ft. are stretched at a tension of 10 lbs. The chief practical advantage of the invar tape is that its small coefficient of expansion not only simplifies measurements generally, but in particular permits of accurate measurements being made in the daytime instead of at night, as is essential in using steel tapes in -line measurement.*

On the wall opposite the comparator i 50-meter U. S. Bench Standard for testi ordinary steel tapes. This has been forme five cold-rolled steel bars, about 33 ft. in len and welded end to end with thermite. As vious to the welding the bars were well fit and cleaned, the result is a continuous bar 5 ft. in length. Not only are the terminal d nces marked by platinum-iridium plugs wi fine transverse lines, but at various regula intervals similar plugs are inserted, so that intermediate distances on a tape can be ified with accuracy. These plugs are inserte very 10 ft. for the tapes with the customary d ions and every five meters for the metric ta the distances being correct at 62° F. for t customary measures and at 0° centigrade the metric scale. Ordinarily the tapes are la flat on the steel bar, but if desired they can b suspended on small pins on the outside of t bar and the conditions of support arranged to imulate those in the field. The bar itself free to move on rollers carried on brackets fastened to the masonry wall and spaced at intervals of 40 ins. so that not only is it kept horizontal but is free to expand and contract with changes in temperature.

The Bureau of Standards not only tests metal tapes for the various government departments, but also for manufacturers and engineers upon payment of nominal fees, depending on the length of the tapes and the number of divisions examined. The charges range from 75 cts. for tapes not longer than 100 ft. and supported throughout the entire length, to $2.25 for tapes 400 ft. in length with comparisons at the 100, 200 and 300-ft. divisions. If the tape is supported at intervals, the Bureau doubles the charge, while determining the coefficient of expansion, testing under different tensions, determining the modulus of elasticity, or other tests are made for suitable and reasonable fees.

The tests can be made as elaborate as desired, but in most cases it is sufficient to compare the tapes merely with the U. S. Bench Standard for the total distance and some of the more important subdivisions, as the coefficient of expansion of the majority of steel tapes is practically that of the standard steel bar—.0000063 per degree Fahrenheit or .0000114 centigrade—so that a direct comparison with the latter suffices and will afford an adequate determination of its accuracy for most purposes. If the tape in construction and tests complies with the requirements of the Bureau, it will be certified and the Bureau of Standards test number corresponding to the number of the certificate issued will be stamped or etched on the tape.

Since the Bureau has undertaken the testing of tapes there has been an increase in the accuracy of those available for engineers, and there is no reason to-day for any one to have any uncertainty about the accuracy of his measures with the Bureau of Standards ready to make final and conclusive tests on payment of a small fee. In the year ending June 30, 1907, 135 tapes were submitted for test by engineers and surveyors in all parts of the country.

* * *

COLLIERY EXPLOSIONS, according to Mr. Simeon Snell, F. R. C. S., Edinburgh, Scotland, are in many cases due to miners' nystagmus, and consequent inability of the miner to detect the presence of firedamp until a dangerous amount is present. To quote from his address at the British Medical Association's annual conference at Sheffield, England, July 28:

> The ordinary method adopted for its detection is by reducing the oil flame of the safety lamp until the luminosity almost disappears, and the firedamp then, if present, appears as a pale blue flame or "cap" above it, this "cap" being due to the presence of gas in the air. Forty-eight miners, from 13 different collieries, were examined, and their incapacity to detect a gas cap unless a dangerous amount of gas was present was very marked in all. The majority of those tested could not see even a large cap. The whole investigation sufficiently demonstrated to my satisfaction that a miner suffering from nystagmus was unreliable as a detector of the presence of gas in the mine.

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*[An article on the use of invar tapes in base- measurements may be found in Eng. News., Vol. LV , p. 612.—Ed.]

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ADVERTISING

"Contract": Rates furnished on application.
"For Sale": $1.50 per inch.
"Proposal": $2.40 per inch.
"Want": See "Want" Pages.

Copy for regular, or "Contract," Advertisements should be received at least ten days before publication; "For Sale" and "Situations Wanted" Advertisements by Monday, and "Proposal" and "Situations Open" Advertisements by 9 A. M. Wednesday.

Entered at the New York Post-Office as Second-Class Matter.

Several months ago, a mining company in the interior of Chile requested us to have manufacturers of mining and smelting machinery forward catalogs and prices. We did so, and quote their letter in reply as follows:

> We are in receipt of your letter and note that you have advised the manufacturers of mining and smelting machinery to forward us catalogs and prices.
>
> We would state that a number of them have already forwarded catalogs, but, with but few exceptions, no prices have been given, the writers almost invariably stating that upon receipt of a letter giving details and specifications, prices would be quoted.
>
> We wonder if these "wide awake" manufacturers realize that it takes a letter from six weeks to two months to reach New York from here and that it is just possible that a concern here might be in a hurry and desire to order supplies by cable, which would be hardly possible without the quotations as well as the catalogs.
>
> At the same time we requested you to have these data sent us from the States we sent to various European manufacturers for the same data, namely, catalogs, price lists and discount sheets. These were promptly sent and for the present these concerns have our trade and have been given orders for some £15,000 of machinery and supplies.

It seems to us that a useful lesson is contained in the above letter for all concerns doing business in engineering supplies. Everyone will concede that it is an essential principle of business success that the seller shall consult the needs and wishes of the customers. Reams have been written about English loss of export trade because of the pigheadedness of English manufacturers in building all their goods to the standard English pattern. Yet here are American manufacturers violating the same principle and losing business to their competitors in consequence.

◆

It is not only in foreign trade that it pays to quote prices. We believe that a large proportion of domestic purchasers would welcome more explicit statements as to prices in trade catalogs. We believe that manufacturers can well take a leaf out of the experience of retail merchants. It has been well established, now, that prices plainly marked on goods displayed in a store window are the best means of attracting customers. It may seem to some that the same rule does not apply to the machine builder that applies to the tailor; but let us see if it does not. An engineer's attention is attracted let us say by a new machine, claimed to produce certain economies over previous practice. The very first thing that the engineer wants to know is the cost of machine so that he can make some approximate figures for himself and determine whether its installation would probably pay or not, and whether he can advise his firm to make the necessary investment.

Of course it is well understood that prices often have to vary with market conditions and conditions of sale. This is a valid reason for the existence of list prices and discounts therefrom; but it is not an excuse for the omission of all prices as is too often done in trade catalogs.

As illustrating that all foreign customers particularly desire prices in order to be able to purchase intelligently, we have another letter before us from an American consul in Africa, requesting that manufacturers send to the consulate "Their catalogs *with lowest prices and exact export retail and wholesale discounts.*"

If the American manufacturer—or rather the American manufacturer's sales manager—will only put himself in the place of the customers in a distant foreign land, he will see at once how necessary prices are to the transaction of business. The trouble is with too many of our "publicity engineers" who make up catalogs that they have in mind their customers in Chicago or New Orleans or Denver. They prepare the catalog merely as a stirring-up rod to awaken the prospective customer's interest and they take it for granted that negotiations by a salesman or by correspondence will precede the actual closing of a contract.

There are customers, however, to whom time is an important element of the contract and who would gladly pay a high price, provided they know what it is in advance and provided the catalog information is explicit enough to enable them to order from it. Long experience in the export trade has schooled British and German manufacturers in catering to the wants of such customers. We in the United States will do well to study the needs of this class of customers as well as those at home.

◆

The name of Bazin has been familiar to all civil engineers, and particularly to all those engaged in hydraulic work for so many years that most members of the profession doubtless class Bazin with Rankine, Fairbairn, Stephenson and other famous names of a generation long since passed away. It is of much interest, therefore to learn that M. Bazin is still living and in good health, although he long ago retired from professional work. While traveling in France last month Mr. Clemens Herschel, of New York City visited M. Bazin at his home in Dijon, and found him in good health at the age of 78 years. The photograph of M. Bazin herewith reproduced (for which we are indebted to Mr. Herschel's courtesy) was taken about 1880, and therefore about the time when the distinguished hydraulician passed the half-century mark.

H. Bazin

Since his return, Mr. Herschel has received an interesting letter from M. Bazin, which we are privileged to print below:

> My dear Sir: I received the pamphlet you announced to me at the time of your kind visit to me. I thank you for it, and have read with great interest the account of these experiments; it is a handsome and useful application of the principle involved. You do right to insist upon the benefit which would arise from the creation of a permanent laboratory for the study of hydraulics.
>
> It was absolutely by chance that I found myself in 1856 at Dijon, "the right man with the right opportunity"; I had never given any attention to hydraulics, my tastes turning only toward mathematical researches. Through association with Mr. Darcy, who was already failing in health, I became his successor, which occupied me several years.
>
> At a later period, I undertook other experiments; and Dijon is probably the city in the world where the greatest number of hydraulic experiments have been made. But my successors in the service did not follow the same path, and nothing now remains of the temporary installations which were established in the course of my experiments.
>
> I am sending you a little paper,* which I probably did not send you when it was issued; because I did not then distribute them. Perhaps the subject will appear to you somewhat singular and of little practical value. But I have nevertheless had occasion to observe that these unstable conditions of water are not as rare as one would be inclined to think.
>
> Having had occasion to look again into your "115 Experiments," I note that you are not a worshipper of the formula of Kutter. I was in correspondence with the author and assisted in its fabrication. It was for the sake of including certain experiments made on the Mississippi, that he thus tortured his formula. But he should have corrected these from the error introduced by the use of double floats, and should have suppressed certain of them, in which the slope of the water surface was really too small to be measurable. He did not do this, and in this way this singular form is the result of an initial error. It has, it is true, the advantage of containing only a single numerical coefficient: n; while that of Mr. Darcy contains two; but it was useless and even harmful to introduce the slope [in the formula for finding the coefficient. Translator's note] as I believe to have demonstrated in 1898, in proposing another formula more simple; I am afraid that this last formula is as yet but little known in the United States.
>
> Other formulas will no doubt be sought for; many people imagine that there must exist a perfect one, which is impossible; the asperities of the perimeter not being susceptible of any exact definition. These formulas cannot be more than guides, and they will never enable the engineer to dispense with his personal experience.
>
> Unfortunately the works that are put into the hands of the practitioner are generally only compilations, which are copied and recopied. When an error has been thus once taken up it is propagated indefinitely; engineers ordinarily have not the time, nor are they willing to take the pains to go back to the original sources; but we cannot prevail against this tendency.
>
> Very sincerely yours,
>
> H. Bazin.
>
> Dijon, France, June 26, 1908.

The contribution by M. Bazin proposing a new hydraulic formula was printed in "Annales des Ponts et Chaussées" for the fourth quarter of 1897. The formula proposed, using metric measures, is as follows:

$$v = \frac{87\sqrt{rs}}{1 + \frac{m}{\sqrt{s}}}$$

The coefficient m varies with the surface of the channel as follows:

Class 1 :	Very smooth (cement, planed wood, etc.	$m = 0.06$
" 2 :	Smooth (plank, brick, cut stone, etc.	$m = 0.16$
" 3 :	Rough masonry	$m = 0.46$
" 3a:	Mixed, or intermediate, very regular earth excavation, paved slopes, etc.	$m = 0.85$
" 4 :	Ordinary earth channels	$m = 1.30$
" 5 :	Earth channels in bad condition	$m = 1.75$

M. Bazin claims that this formula is more accurate than the formula of Ganguillet and Kutter and is easier to use. Interested readers will find a discussion of this new formula with tables in the eighth edition of Merriman's "Treatise on "Hydraulics," Art. 118.

◆

STATE CONTROL OF SEWAGE DISPOSAL WORKS.

London, Paris, Berlin, and a large proportion of the lesser cities of Europe were forced to purify their sewage years ago. In contrast, no American city of the first rank has sewage purification works in operation to-day. Baltimore, with a half million population in 1900, is building sewage works; Providence, R. I., and Worcester, Mass., both much smaller cities, have works in use; and works are being built by Columbus, O. In Canada, Toronto has just voted the long-needed money for improved means of sewage disposal. Of smaller cities there are now some scores with sewage purification, but the number without is many times larger.

---

*NOTE BY THE TRANSLATOR.—This pamphlet is a reprint from "Annales des Ponts et Chaussées," dated Feb. 10, 1904, being a note upon "The unstable condition and the changes of form of certain liquid veins.")

Why this difference between Europe and America? The difference, primarily, is one of different natural conditions. With a weaker sewage and a sparser population we have, in addition, far ampler natural waters for sewage disposal by dilution than have European countries generally. Years back, many of the streams of England, for instance, had become gross nuisances through sewage pollution. River conservancy boards were created to force remedies of these nuisances in the case of a few streams, but probably far more compulsion in the establishment of sewage works has come from the Local Government Board, which passes on bonds for many classes of municipal improvements and insists on purification of sewage from new sewerage systems and from extensions to old systems.

In the United States, with its fifty commonwealths, each sovereign over its internal affairs, there has been comparatively little central control of sewage disposal. For years after the awakening of England to the need of such supervision Massachusetts afforded the solitary instance of effective supervision of plans for sewage disposal.

To-day, Massachusetts, New York, New Jersey, Pennsylvania, Ohio and Kansas exercise a fairly rigid control of sewage disposal. This, since the recent consolidation of the State Sewerage Commission and the State Board of Health of New Jersey, is all effected through the respective state boards or departments of health. Beginning with power to veto or approve plans for new construction, only, all these states save Massachusetts now have more or less authority to order municipalities to stop polluting natural waters.

As prohibiting pollution is nearly always equivalent to ordering the construction of sewage purification works, at greater or less expense, the question naturally arises: To what extent should pollution be prohibited? The most radical would prohibit the discharge of crude sewage into any body of water, fresh or salt, regardless of size and all other local conditions. The least radical, of those who believe in any prohibition whatever, would not go beyond the protection of public water supplies and the prevention of gross offenses to the nose and eye.

The rational course is to judge each case on its merits, in the light of a considerable variety of local as well as extra-territorial conditions. And herein lies the imperative need for central control over sewage disposal. The wisest local authorities may, conceivably, give due weight to all their purely local conditions, but it is not human nature to expect that they will give proper consideration to the effect of their sewage disposal methods on that part of the public outside their limits. To protect the general public the state, as representing that public, must intervene. As a matter of experience, the locality primarily concerned is often in need of protection against its own ignorance or negligence in matters of sewage disposal. It is for such reasons that a number of states have vested the control of sewage disposal in their state boards of health, as already noted, and that others may be expected to follow with increasing rapidity.

How rapidly can a state board of health move in compelling municipalities to build sewage purification works, assuming that it has ample powers to that end?

The time has not yet come when all discharge of crude sewage into water should be prohibited, regardless of the degree of dilution afforded and the use to which the water is put. Until other imperative municipal needs are met and until sewage treatment has attained far more of a finality and can be effected at far less cost than is the case to-day, sewage disposal by dilution must continue to be recognized as proper; provided, of course, no public water supply is endangered, and no grave nuisance is created. For the present, varying degrees of danger to public water supplies may have to be tolerated, in many cases, and the burden of protection thrown on the purification of the water supply. In fact, sewage purification is far from having attained that degree of perfection and cheapness which would make it, rather than water purification, a safe reliance where public water supplies are involved. This statement should not be interpreted as exempting municipalities from so disposing of their sewage as not to obviously endanger public water supplies. Where sewage purification will not afford safety then diversion to some other point of disposal may become necessary. An alternative that has been given little consideration as yet is a contribution to the expense of purifying the water consumed by the other municipality.

In the matter of nuisances caused by sewage disposal methods, nuisances of no or only very indirect effect upon the public health, far more latitude will have to be granted for years to come than would be right where the purity of public water supplies is involved. The ideal, of course, is to prohibit any such nuisance, but in many states such an ideal will be long in the attainment. The only or the chief justification for continuing nuisances of this sort will be that other demands upon the municipal purse are of more importance.

Obviously, far more strictness may be expected in the case of new than of existing sewerage systems. The municipality that is just building sewers has a relatively free hand and can reasonably be compelled to adopt disposal methods that would be over-burdensome as an appendage to old works, not designed with purification in view.

We are well aware that quite another view may be taken of the matter discussed in the last few paragraphs. It may be urged, and with much reason, that no municipality, corporation or individual has a right to so rid itself of its wastes as to cause a nuisance or a menace to health. Abstractly, this cannot be contradicted. Concretely, it applies with great force to new works. Practically, as regards old works, it becomes absolutely necessary, in many instances, to tolerate some of the evils of water pollution for at least a few years longer. The fact of the matter is that all have been sinners in the past, in greater or less degree, and all must suffer more or less in the future for having permitted many sanitary evils to take root and wax great. Those who have been sufferers only, rather than sinners, in the matter of water pollution, must bear a share of the blame for the long delay in enacting legislation against stream pollution and in providing means to ensure the enforcement of the statutes; and because of this they must have some tolerance of delay in righting old wrongs.

There is much more that might be said on this large and perplexing subject. Our object has been merely to call attention to the progress that has already been made in establishing state control of sewage disposal and to some of the difficulties involved in exercising that control. We expect to see that control extended to many other states, and eventually to all of them, and confidently look forward to some measure of federal control over the pollution of interstate streams. Meantime hosts of cities and towns, including some of first rank, will be added to the list of municipalities having works for at least the partial purification of their sewage, and coincident with this our knowledge of the art will increase and, let us hope, the cost of the process will decrease.

We cannot close without calling attention to the fact that effective state control of sewage disposal does not stop with passing on plans. It is essential that the plans submitted and approved be properly executed. But this is only the beginning. The works built must be properly operated. It is here that we see failure on every hand, with all-too-rare exceptions. The State of Ohio has recognized this and has become the pioneer in giving its State Board of Health supervising control over the *operation* of sewage disposal works (see Eng. News, April [illegible] 1908). We may reasonably expect that other states will follow this excellent example.

LETTERS TO THE EDITOR.

Inaccuracy in Turnouts Due to Frog Being Straight.

Sir: In none of the tables pertaining to frogs are the tabulated figures giving frog distance, turnout radius, etc., right, that is to say, in none that I have ever seen.

Referring to Trautwine (p. 786), they are supposedly given for all frog numbers from 4 to 12. They are not right, because they all assume that the curve starts at the frog point, which in no frog I ever saw is the fact. The stock frog and what you get when you order is ordinarily 15 ft. long and has straight rails; therefore, the frog point being midway, you have 7.5 ft. of tangent both sides of the point. For example, in a No. 9 frog, angle 6° 22′, the center line of the turnout radius is 586.5 instead of 763, as given by Trautwine, the frog distance 76.8 instead of 84.7 ft.

I have never seen this matter mentioned that I remember. It is admitted not of great importance, but it is well enough to know it. You cannot with absolute accuracy commence at the switch point and run the curve around continuously, as there will be 15 ft. of tangent in it. This also accounts for the remark of the roadmaster that when center stakes were given him from the frog point, he "could never get on to the first stake, but could on to the second," stakes being 10 ft. apart.

Of course the middle and side ordinates are not right either, and you can't get the rails in on them as given.

On the basis for a No. 9 frog the subtangents are 34.47 and the external 0.91 ft.

E. T. Abbott.

Thrall, Cal., July 22, 1908.

Friction Error in Waddell's Column Tests, and the Need for Government Tests of Columns.

Sir: Referring to the article in your issue of Jan. 16, 1908, by Mr. J. A. L. Waddell, on certain tests of built steel columns, and to a subsequent reference to the subject by Mr. A. W. Carpenter, in your issue of May 14, 1908, it would appear to the writer that a few words further would not be out of place and might afford real information to many members of the profession.

In your issue of Dec. 26, 1907, a number of column tests covering ten years or more were reported by Mr. C. P. Buchanan, and a discussion on them by Mr. Carpenter appeared in the issue of April 9, 1908. Mr. Waddell in the article above referred to reported a set of tests of his own, on columns of both carbon-steel and nickel-steel, these tests being made on the machine belonging to the Phoenix Iron Co., at Phoenixville, Pa., and further, he drew from these tests conclusions of various sorts.

According to the figures there presented, the columns tested by Mr. Buchanan showed an elastic limit averaging some 15% less than his own (referred to the same ratio of length to radius of gyration) and the ultimate strength averaged about 8% less; a fact which, after eliminating other possible reasons, he ascribed to the superior detailing of his specimens. He then took up his tests in detail, and showed that the elastic limit and ultimate strength of all the columns tested conformed to the results obtained by applying the formulas of "De Pontibus," with most surprising accuracy.

In your issue of May 14, Mr. Carpenter made an inquiry regarding friction in the Phoenixville machine, asking whether Mr. Waddell's figures had been corrected for this error. According to the best information obtainable no such deductions were made, though Mr. Waddell may be able to correct the writer on this point. A calibration of this machine was made by Mr. W. W. Ewing of the Department of Buildings of New York City (see Engineering News of Jan. 13th, 1898) and subsequent investigations have only confirmed his results. His figures show the friction error in compression tests to be between 15% and 17%, averaging probably nearer the larger figure. If this correction be applied to Mr. Waddell's figures it will be seen that his columns were no better than Mr. Buchanan's, if as good, and further, that the coincidence of the "De Pontibus" formulas with the results obtained from tests is more apparent than real. So far as the writer knows, Mr. Carpenter's question above noted has not been answered by Mr. Waddell, and yet it seems sufficiently pertinent to deserve some sort of reply.

It would appear to the writer, moreover, that Mr. Waddell's perfect confidence in the "commonly accepted formulas" for column is hardly warranted by the facts cited above. A number of tests which have recently been made (and which are still going on) on the above-mentioned machine, on columns of various design and

COST OF REPAIRING ASPHALT PAVEMENTS AT UTICA, N. Y.

Asphalt pavements laid			
Year laid.	Area, sq. yds.	Guar. expiration.	Age in 1907, yrs.
1886	14,571	1891	21
1888	31,888	1893	19
1889	37,229	1894	18
1890	31,686	1895	17
1891	5,966	1891	16
1891	28,319	1896	16
[illegible]	6,914	1898	14
[illegible]	606	1894	13
[illegible]	83,709	1899	13
[illegible]	54,415	1900	12
[illegible]	10,639	1901	11
[illegible]	28,630	1906	11
[illegible]	74,741	1907	10
Total	410,313	....	..
Average age, 1907			14 yrs.

Cost of repairs and yardage out of guaranty during each year.					
				Cost of repairs.	
Year.	Total out of guar., sq. yds.	Resurfaced, sq. yds.	Net area, out of guar., sq. yds.	Total.	Per sq. yd.
1891	20,537	......	20,537	......	....
1892	20,537	......	20,537	......	....
1893	52,425	......	52,425	......	....
1894	90,260	......	90,260	$97.01	$0.001
1895	121,946	......	121,946	586.48	.005
1896	150,265	......	150,265	224.49	.001
1897	150,265	......	150,265	1,185.24	.008
1898	157,179	......	157,179	2,054.14	.013
1899	240,888	......	240,888	2,986.06	.012
1900	295,303	......	295,303	2,635.08	.009
1901	305,942	8,565	297,377	7,039.56	.024
1902	305,942	......	297,377	4,002.81	.014
1903	305,942	......	297,377	4,335.24	.014
1904	305,942	532	296,845	9,421.14	.031
1905	305,942	2,400	294,445	7,796.22	.027
1906	334,572	24,046	200,029	7,609.73*	.025
1907	410,313	17,146	357,624	12,840.80	.035
....	....	52,689	....	$62,814.00	....
Average for 17 yrs.			202,323	$3,695.00	.018

material, make their infallibility appear rather doubtful; and even what may be called the standard make-up of column sections (proportion of webs, angles, covers and lattice) seems open to grave question. The writer agrees with Mr. Waddell that the greatest need of the profession at present is an exhaustive series of compression tests, made on a machine designed for the purpose. Such a machine, of a capacity several times that of any existing to-day, should be provided by the National Government.

Yours very truly,
Sumner Gowen.

Phoenixville, Pa., July 28, 1908.

◆

Cost of Repairs to Asphalt Pavements, Utica, N. Y.

Sir: There have recently been brought to our attention some interesting data on the above subject, which have been prepared by Mr. Paul Schultze, City Engineer of Utica from 1899 to 1908, and which have been certified to by him as taken from the city records. They are of the greatest interest, and we desire to bring them to your notice.

Considering the average age of the pavements, many of them constructed with Obispo and other asphalts, the average cost of repairs for 17 years, 1.8 cts. per sq. yd. per annum, is surprisingly low, and compares favorably with the figures given in a report of Captain Newcomer on the cost of repairing pavements in Washington, which was made public some four years ago, the figures of which are reprinted in our [Clifford Richardson's—Ed.] book, "The Modern Asphalt Pavement," page 471.

During 1907, quite extensive repairs were made to the Utica pavements, and in that year the cost was only 3½ cts. per sq. yd., the pavements averaging 14 years in age, some of them 21 years old, and none less than 10 years old.

During each year there has been deducted from the total yardage out of guarantee, the yardage that was resurfaced in each respective year, and the average cost per square yard per annum has been calculated on the net yardage with the resurfaced work left out. All of the resurfaced work carries a 10-year guarantee, so that the earliest of these resurfaced streets does not expire until 1911. We cite this fact in view of possible criticism that the cost of resurfacing should also have been included in the cost of repairs. Since the resurfacing cost the city only about $1.50 per sq. yd. and is guaranteed for ten years, it does not seem proper to include the resurfacing work in a calculation of this kind, at least until the guarantee on it has expired.

In view of the fact that the Utica repair work has always been done by contract and not by a municipal plant, these figures have additional interest, and you may be desirous of noticing this fact, as you have done with the figures prepared recently by the municipal plant department of the city of New Orleans (Eng. News, Jan. 2, 1908) and the Borough of Brooklyn (Eng. News, May 21, 1908.

Yours very truly,
New York Testing Laboratory.

30 Church St., New York City, Aug. 4, 1908.

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Notes and Queries.

The article on "Sewer Construction at Gary, Ind.," in our issue of Aug. 6, incorrectly mentioned Mr. E. M. Scheflow as Engineer of Construction for the contractors. Mr. Scheflow is Assistant City Engineer, and was in charge of the work on behalf of the city.

Mr. William P. Bacon, 50 Lexington Street, New Britain, Conn., desires the present address of Mr. Alfred Otis Delano, or, if Mr. Delano is deceased, would like to know the date and place of his death. Mr. Delano was born in 1839, and graduated from Yale College with Mr. Bacon in the class of 1858. From March, 1858, to September, 1859, Mr. Delano was on the Brooklyn Water-Works, and from then until November, 1860, he was successively engaged on government work at Sandy Hook, on the Staten Island Railroad, and as Assistant Engineer of the Raritan & Delaware Bay Railroad.

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STATEMENT OF THE ASSOCIATION FOR THE DEFENSE OF SEPTIC PROCESS SUITS.

On Jan. 6, 1904, the Cameron Septic Tank Co. brought suit against the Village of Saratoga Springs, N. Y., for infringement of U. S. Patent No. 634,423, granted Oct. 3, 1899, to Donald Cameron and others for process of and apparatus for treating sewage. On March 12, 1907, the opinion of the Circuit Court was filed and in brief was as follows:

(a) That the process claims were invalid in view of the prior art, as evidenced by both publications and prior uses, being anticipated thereby.
(b) That the process claims were invalid as covering a process of nature.
(c) That the apparatus claims were invalid in view of the prior art and anticipated thereby.
(d) That, even if valid, defendants did not infringe.
(e) That there was no patentably new conception in the patent in suit.

The case then went to the Circuit Court of Appeals of the Second Circuit, and on Jan. 7, 1908, the Court filed its opinion affirming the decree of the Circuit Court as to apparatus claims, but reversing the decree of the Circuit Court as to process claims.

Petition for rehearing was filed by defendant, setting forth what were believed to be actual mistakes of fact in the decision of the Court of Appeals, as well as calling attention to certain omissions in their consideration of the prior art. Such petition for rehearing was denied.

The opinion of the Court of Appeals as to the process claims left in a very uncertain state the very important question as to what does or does not constitute infringement, and in view of the widespread importance of the matter, and the fact that it so intimately involves the health of the public at large, authorized representatives of a score or more cities and towns met at Harrisburg, Pa., on March 9, 1908, and there formed the Association for the Defense of Septic Process Suits.

The primary object of the association thus formed was decided to be the carrying of the case in question to the Supreme Court of the United States on a writ or certiorari. In the petition filed with the Supreme Court on April 4, 1908 (October term, 1907), the process claims 1, 2, 3, 4 and 21, the only ones now involved, were recited as consisting in:

(1) Subjecting the sewage under exclusion of air, of light and of agitation to the action of anaerobic bacteria until the whole mass of solid organic matter contained therein becomes liquefied, or
(2) Secluding a pool of sewage having a non-disturbing inflow and outflow from light, air and agitation until a mass of micro-organisms have been developed of a character and quantity sufficient to liquefy the solid matter of the flowing sewage, the inflow serving to sustain the micro-organisms, and then subjecting said pool under exclusion of light, air and agitation and under a non-disturbing inflow and outflow to the liquefying action of the so cultivated micro-organisms until the solid organic matter contained in the flowing sewage is dissolved.

In other words, all the process claims call for is the retention of the solids in the tanks (which are free to the public to use, and to build for the purpose of holding said solids and allow for a non-disturbing inflow and outflow with aeration and filtration) long enough for the process to work itself out without the aid of man or mechanical appliances.

In the briefest terms, the decision of the Court of Appeals permits the public to build without infringement tanks in strict accordance with Cameron's apparatus claims, and to use such tanks for the treatment of sewage. But as the case now stands, while the public may do this much without infringement the one thing the public must *not* do is to permit natural agencies to become operative, for then, the Court decides, Cameron's process patent claims are infringed. Nature must be circumvented in some way (the Court does not say how), or legal difficulties will follow.

The petition for writ of certiorari was denied by the Supreme Court of the United States and the decision of the Circuit Court of Appeals of the Second Circuit was upheld.

As the case now stands it is not at all clear how much of the process the Court considers a natural one, how far the anaerobic treatment of sewage may be practiced without infringement, or how far the systems in use prior to Cameron may be utilized without infringement of his process claims. In this connection a few uncertain features in the decision of the Court of Appeals may be mentioned.

(1) Great stress is laid in the clause in the patent claims surrounding a *continuous flowing current of sewage*. Would intermittent operation of such tanks be an infringement of the process claims?

(2) The formation of scum in a septic tank is said to constitute a cover, and thereby fulfill the requirements in the claims as to seclusion from light and air. If scum does not form or is not permitted to form in a tank and the tank is otherwise uncovered, is the patent avoided?

(3) It is clearly set forth in the testimony of both sides and in the decision of the Court, that true septic action does not become established in a septic tank until such tank has been in continuous operation in the treatment of sewage for several weeks or months. If the sludge which deposits in such tanks is removed at intervals of six weeks or so, is infringement of the Cameron patent avoided?

The Cameron patent, so far as the claims now declared valid are concerned, will expire on Nov. 2, 1909. The association for the Defense of Septic Process Suits believes that the decision of the Circuit Court of Appeals is not capable of such sweeping interpretation as the Cameron Co. desires to put upon it; that the decision is of extremely limited application; that the vast majority of plants where the so-called septic process of sewage treatment is used are not infringements of the process claim of said patent; and, furthermore, that there are many lines of defense which may be raised even now to the process claims as interpreted by the Court of Appeals of the Second Circuit. The association is determined, furthermore, to resist all attempts on the part of the Cameron Co. to have the case re-opened so far as their apparatus claims are concerned, unless the whole case, including the process claims, is reviewed; and, finally, to resist all attempts on the part of the Cameron Co. to obtain an extension of any part of U. S. patent No. 634,423 beyond Nov. 2, 1909.

Although the Cameron Septic Tank Co. originated in England, we learn, from leading English engineers, that no royalties are paid in that country for the use of the septic process.

The association has received, and is still receiving, contributions to a fund for the legal defense of its members in all branches of this matter, and invites contributions on the part of the municipalities or individuals designing, building or utilizing the so-called septic process of sewage treatment. Should demands be made by the Cameron Co. upon such municipalities or individuals for royalties for infringement it is the advice of the association that such demands be referred to this association for an opinion by its counsel as to the rightfulness of the demands made, and for advice as to procedure to avoid infringement if such appears to exist according to the recent decision of the Circuit Court of Appeals. A full history of the plant and the manner of its operation should be submitted at the same time.

It is the intent and purpose of this association, furthermore, to render all possible advice and assistance in the equitable adjustment of claims for past use of the so-called Cameron process of sewage treatment which appear to come within the decision of the Court of Appeals. It is the final advice of this association that all negotiations and correspondence with the Cameron Co. be carried on through the Executive Committee of this association.

The executive and finance committee of the association is as follows:

F. Herbert Snow, President, Chief Engineer, State Department of Health, Harrisburg, Pa.
R. Winthrop Pratt, Secretary, Chief Engineer, State Board of Health, Columbus, Ohio.
George A. Johnson, Treasurer, Consulting Engineer, 170 Broadway, New York.
Robert A. Cairns, City Engineer, Waterbury, Conn.
Wade H. Ellis, Attorney General, Columbus, Ohio.
T. Chalkley Hatton, Consulting Engineer, Wilmington, Del.
G. Everett Hill, Consulting Engineer, New York City.

All inquiries should be addressed to the President or to the Secretary, and all remittances be made direct to the treasurer.

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TWO FIRES IN PHILADELPHIA, July 31, destroyed Pier 46 of the Hamburg-American Line at the foot of Washington Ave. and the fish wharves at Delaware Ave., and Spruce St. The fire on Pier 46 was started by sparks from a locomotive which pulled a train of freight cars into the shed on the pier. Hundreds of tons of goods stored for shipment in this shed were destroyed.

A BOILER EXPLOSION at the York Rolling Mill, York, Pa., killed eight men and completely wrecked the building. The plant of the Broomell, Schmidt & Stacy Co. nearby was badly damaged, and windows were broken in houses a quarter of a mile away. The mill had been closed for a week and 100 men were making repairs on the engine when, without warning, the boiler exploded.

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AN INTERURBAN COLLISION on the Western Ohio electric lines, near Sidney, Ohio, Aug. 10, resulted in the death of five people, while 40 others are reported injured. A south-bound car out of Sidney was late and running at great speed. It met a north-bound car from Piqua, which was running on time, in front of the Shelby County Infirmary. The accident is ascribed to a misunderstanding of orders.

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THE ZEPPELIN DIRIGIBLE BALLOON, whose record-breaking journey from Lake Constance, Germany, was noted in Engineering News, Aug. 6, was demolished in a severe storm that arose shortly after the airship had landed near Echterdingen. The wind tore the balloon from its moorings and, from some unknown cause, the gas exploded. Several soldiers who were guarding the balloon were severely injured. At the news of the disaster, contributions, both public and private, from all parts of Germany were offered for the immediate construction of a new dirigible. These contributions are reported to aggregate nearly $700,000.

The promoters of the exhibition trip of Henry Farman, the Parisian aeronaut, are reported to have abandoned the enterprise, and it seems probable that the exhibition flights of this aeroplane in this country have come to a sudden end.

Wilbur Wright, of Dayton, Ohio, has made successful flights during the past week at Le Mans, France, with the type of aeroplane with which his American experiments have been made. Several noted spectators are reported to have said that his performances indicate far greater progress in aeronautics than has been attained by any other inventor.

In this country the forthcoming tests of dirigibles and aeroplanes for the Army Signal Corps continue to promise the greatest interest to aeronauts. The dirigible balloon of T. S. Baldwin, recently examined by a special board of signal officers, has been declared built in acceptable accordance with the specifications of the proposal accepted by the government. The official trial flights have yet to be made. The aeroplanes of A. M. Herring and of the Wright Brothers will be tried out after the Baldwin dirigible is disposed of.

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THE MANHATTAN SUSPENSION BRIDGE across the East River at New York City has progressed so far that the work of stringing the wires which form the cables has begun. There are 9,472 wires in each of the four cables, the wire being No. 6 Birmingham gage. The method used for stringing them is similar to that used in the Williamsburgh Bridge (Eng. News, Dec. 17, 1903, p. 541). The Glyndon Construction Co. is doing the work. The wire is made by the John A. Roebling Sons' Co., of Trenton, N. J.

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THE NEW CHICAGO TERMINAL STATION of the Chicago & Northwestern Ry. will occupy about four city blocks and will have its main front on Madison St., between Canal and Clinton Sts. The cost of the building alone will be about $4,000,000, while the approaches (with elevated tracks) will cost about $8,000,000. The expenses for land and right-of-way will bring the total cost to about $20,000,000. The building will be of gray granite. The design is of the classic type, with a colonnade 120 ft. high forming the main entrance. The six main entrance stairways will aggregate a total width of 100 ft. There will be three main floors. At the street level, the main entrance will open into a concourse 100 × 250 ft., convenient to the ticket offices, baggage rooms, and special accommodations for immigrants. There will be a separate concourse and other facilities for the suburban traffic. On the second floor, level with the station platforms, will be the waiting rooms, the main room being 100 × 200 ft., and 80 ft. high, with a vaulted ceiling. The third floor will have ladies' rooms, barber shop, and other accommodations.

The present terminal station at Wells and Kinzie Sts. was built in 1882. An annex for suburban traffic was built a few years ago and additional tracks have been laid from time to time. The passenger accommodations and train facilities are, however, very inadequate for the present traffic. All traffic is throttled by having to cross a double-track swing bridge just outside the station, but this is now being replaced by a four-track Scherzer rolling-lift bascule bridge. There are now over 300 trains entering and leaving the station daily, and there is a very heavy suburban traffic.

The site is now being cleared, ready for sinking the foundation caissons, which will go down about 106 ft. to bed rock. It is expected to have the station completed by January, 1910. The architects are Frost & Granger, of Chicago. Mr. E. C. Carter, M. Am. Soc. C. E., is Chief Engineer of the Chicago & Northwestern Ry.

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A REMARKABLE RAILWAY ACCIDENT is reported by the Pierre (S. Dak.) "Capital-Journal:" A freight train on the Chicago & Northwestern Ry., which left Pierre on the evening of Aug. 5, lost a car out of the middle of the train when a few miles from the city, without the knowledge of the train crew. The car in question was derailed, the drawbars at both ends pulled out, dropping to the track with the attached couplers; the rear section of the train pushed the derailed car out of the way and on running forward again became coupled to the forward section by the automatic couplers. The drawbars lying on the track nearly derailed a passenger train which came by soon afterward in the opposite direction. The passenger train crew, finding the lost car, wired back to the freight asking whether it belonged to their train, and only on checking up their cars the freight crew discovered their loss.

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COMPENSATION FOR INJURIES is granted to certain employees of the United States by an act which came into effect Aug. 1. According to a statement issued by the U. S. Department of Commerce and Labor:

> The new law applies to persons employed by the Government as artisans or laborers in the following services: Arsenals; navy yards; river and harbor construction; fortification construction; hazardous employment in the Reclamation Service, namely, in construction and in control and management of works; hazardous employment under the Isthmian Canal Commission; Government manufacturing establishments.
>
> The compensation consists of a continuance during the period of disability, but not over one year, of the same pay which the employee was receiving at the time of the injury. If the employee is killed by the accident or dies from the results of the injury received and leaves a widow, children under 16 years of age or dependent parents, the same amount of compensation is paid to these dependent relatives until the completion of the twelve months' period.
>
> The records of the application of this act will furnish valuable material for statistics of accidents, which, for this country, are quite meager. In order to make the statistics more complete and valuable, reports of all accidental injuries to Government employees, regardless of the application of this act, have been requested from all Government establishments and offices. As the number of United States Government employees exceeds 300,000, these statistics will prove of great scientific value and practical use in the future.

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THE MONTHLY BACTERIAL CONTENTS of the Thames River water supplied to the filters of London, England, during the year ending with March, 1908, ranged from 436 as the average for August, 1907, to 13,454 for January, 1908, and averaged 3,170 for the year. The average effect of subsidence and slow sand filtration was to reduce the year-average of 3,170 in the raw water to 11 in the treated water, or 99.6%. For the whole year 79% of 5,512 samples of filtered Thames water contained no B. coli in 100 c. c., the range for the year having been 90.9% in June and 23.4% in January. Dr. A. C. Houston, Savoy Court, Strand, W. C., London, England, is Director of Water Examinations, Metropolitan Water Board.

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PERSONALS.

Mr. W. N. Morrill. Assoc. M. Am. Soc. C. E., has resigned as Constructing Engineer of the Sewer Commission of Lexington, Ky., to engage in other business.

Mr. G. O. Scanland, formerly Assistant Gen. Auditor of the American Car & Foundry Co., in St. Louis, has been appointed acting district manager of that company at Jeffersonville, Ind.

Mr. R. Fleming Arnott, Assoc. M. Inst. C. E., formerly Mechanical Engineer with the Hudson Co.'s., has opened an office as a consulting engineer at 95-97 Liberty St., New York City.

Mr. Albert J. Marshall has severed his connection with the Holophane Co., and has become Chief Engineer of the Bureau of Illuminating Engineering. His office is at 437 Fifth Ave., New York City.

Mr. P. Ney Wilson, for the past two years Superintendent of Construction for the Rochester Ry. Co., has resigned to take a position with the engineering force of the Mack Paving & Construction Co., of Philadelphia.

Mr. F. G. Clapp, of the U. S. Geological Survey, has resigned to enter into partnership with A. W. Bee, Jr., Civil Engineer. They have opened an office as consulting engineers in Room 610, Fitzsimons Bldg., Pittsburg, Pa.

Mr. John V. Beekman, Jr., Assoc. M. Am. Soc. C. E., formerly Boston Manager, Purdy & Henderson, has become General Manager of the firm of Whidden & Co., Inc., consulting engineers. His address will be 155 Milk St., Boston, Mass.

Mr. William Hand Browne, Jr., for the past seven years editor of the "Electrical Review," has resigned that work to become Professor of Electrical Engineering and Physics at the North Carolina College of Agriculture and Mechanic Arts, at Raleigh. Mr. Browne graduated from Johns Hopkins University, was then engaged in street railway work, and taught for several years, leaving the post of Assistant Professor of Electrical Engineering at the University of Illinois to take up the editorial work of the "Electrical Review."

Obituary.

Harris Tabor, M. Am. Soc. M. E., died July [illegible] at his home in Philadelphia, as the result of injuries received in an automobile accident July 4, 1907. Mr. Tabor is best known as the inventor of the Tabor steam engine indicator and the Tabor molding machine. He was born at Clarence, Erie Co., N. Y., in 18[illegible]. At the age of 21, he enlisted as a private in Company F, 23d New York Volunteer Infantry, and served with that regiment in the Civil War. He afterward worked with various manufacturing companies in Pennsylvania and New York, and, in 1882, became Superintendent of the Hartford Steam Engine Co., at Hartford, Conn. The following year he went to Pittsburg as Superintendent of the Westinghouse Machine Co., and remained with that company about two years. From this time on until 1900, he was engaged in the development and manufacture of molding machines and other mechanical appliances of his own invention. The first successful molding machine was put on the market in 1888. It was operated by an overhead steam cylinder. From 1900 to 1906, Mr. Tabor partially withdrew from the Tabor Mfg. Co., of which he had been President, and practised as a consulting engineer; but afterward (June, 1906), he again took an active part in the affairs of the company, which was then located in Philadelphia, and remained with it up to the time of his last illness. He was buried Aug. 1 at Lebanon, Pa.

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ENGINEERING SOCIETIES.

COMING MEETINGS.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
Aug. 19-21. Annual convention at Detroit, Mich. Secy., Frank P. Foster, Corning, N. Y.

THE TRAVELING ENGINEERS' ASSOCIATION.
Aug. 25. Annual convention at Detroit, Mich. Secy., W. O. Thompson, New York Central Shops, East Buffalo, N. Y.

NEW ENGLAND WATER-WORKS ASSOCIATION.
Sept. 23-25. Annual convention at Atlantic City, N. J. Secy., Willard Kent, 715 Tremont Temple, Boston, Mass.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Sept. 29. Annual meeting at Birmingham, Ala. Secy., R. W. Raymond, 29 West 39th St., New York City.

LEAGUE OF AMERICAN MUNICIPALITIES.
Sept. 30-Oct. 2. Annual convention at Omaha, Neb. Secy., John MacVicar, Des Moines, Iowa.

ILLUMINATING ENGINEERING SOCIETY.
Oct. 6-7. Annual convention at Philadelphia, Pa. Secy., Van Renselaer Lansingh, Engineering Societies' Building, 33 West 39th St., New York City.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.
Oct. 12-16. Annual convention at Atlantic City, N. J. Secy., B. V. Swenson, 29 West 39th St., New York City.

RAILWAY SIGNAL ASSOCIATION.
Oct. 13-15. Annual meeting at Washington, D. C. Secy., C. C. Rosenberg, 12 North Linden St., Bethlehem, Pa.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.
Oct. 20-22. Annual convention at Washington, D. C. Secy., R. H. Reid, Lake Shore & Mich. Southern Ry., Cleveland, Ohio.

AMERICAN ELECTROCHEMICAL SOCIETY.
Oct. 30-31. Fall meeting at New York City. Secy., Dr. J. W. Richards, Bethlehem, Pa.

VERMONT ELECTRICAL ASSOCIATION.—The seventh annual convention will be held at Bennington, Vt., Sept. 16-17.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—The annual meeting will be held at the Grand Hotel in Cincinnati, Aug. 18-20.

MICHIGAN GAS ASSOCIATION.—Secy., Alonzo P. Ewing, Gas Office Building, Detroit, Mich. The annual meeting will be held at Kalamazoo, Mich., Sept. 23-25.

NATIONAL ASSOCIATION OF RAILWAY COMMISSIONERS.—The next convention will be held at Washington, D. C., Oct. 6. Mr. W. H. Conolly, Washington, D. C., was elected Secretary at the last convention.

THE INCORPORATED ASSOCIATION OF MUNICIPAL AND COUNTY ENGINEERS.—Secy., Thomas Cole, 11 Victoria St., London, S. W. A delegation of ten members from this association will attend an International Roads Congress which will be held in Paris, Oct. 11 and following days.

AMERICAN PUBLIC HEALTH ASSOCIATION.—The 36th annual meeting will be held at Winnipeg, Man., Aug. 25-28. Among the papers prepared for this meeting are the following: "Pollution of the Great Lakes and Rivers"; "Control of International and Interstate Water Supplies"; "Control by Patent of Sewage Disposal Methods"; "English Sewage Purification Plants."

AMERICAN CHEMICAL SOCIETY.—At the New Haven meeting, a Division of Industrial Chemists and Chemical Engineers was organized, including a large proportion of the membership of the society and especially those engineering chemists whose work is directly concerned with industrial development and progress. The division will begin the publication, at an early date, of the Journal of Industrial and Engineering Chemistry.

ENGINEERING LITERATURE

Supplement to ENGINEERING NEWS. 220 Broadway, New York, August 13, 1908.

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CORRESPONDENCE.

Baldwin on Heating.

Sir: I have read with interest Professor William Kent's review of the recent edition of my book, "Baldwin on Heating," and I wish to thank Professor Kent for what he has to say concerning the same. There are, however, one or two of his statements in regard to which I would like to say a few words.

Professor Kent states that I do not show that "the carrying power of pipes, with the same length and the same difference of pressure, is as the 2.5 power instead of the square of the diameter." I do point out this very fact in connection with the loss of pressure due to friction, and I show in the curve, EE, in Fig. 80, a graphical illustration of this very fact. There are, however, conditions under which the carrying power of the pipes will not vary as the 2½ power of the pipe diameters. With short pipes, for example, where the loss due to friction is relatively negligible and the loss due to influx is relatively large, the quantity of steam passed under fixed differences of pressure will vary as the square of the pipe diameters.

In a gravity apparatus, also, the allowable loss in pressure throughout the entire apparatus is fixed if the difference in level between the water line in the boiler and the lowest point in the steam main is a constant. Under these conditions, which are the usual ones in a gravity apparatus, the increased length of the mains in larger apparatus (longer mains), makes necessary a smaller drop in pressure per unit length of pipe. For this reason the quantity of the radiation supplied is more nearly in the proportion of the squares and it is not at all as the 2½ powers of the diameters of the pipes.

Professor Kent states that a table which has been in use for over ten years allows a capacity of 39,000 sq. ft. of direct radiation for a 10-in. pipe. This table is figured for a loss of pressure of $1/10$-lb. per 100 lin. ft. of straight pipe. The loss of pressure in elbows and fittings adds greatly, of course, to the loss of pressure in the straight pipe itself.

Whether so large a drop of pressure is allowable in any particular apparatus depends entirely upon the surrounding conditions, but it is apparent that any such loss of pressure is prohibitory in practically every gravity heating apparatus, which supplies any considerable amount of heating surface, and this was the subject under discussion where the pipe sizes are given, to which Professor Kent objects.

Professor Kent also says that "two methods of providing for expansion are shown, a V loop and two right angle bends, but a more approved method for long lines, two swinging joints, is omitted."

If Professor Kent had seen as much trouble result from the use of two swinging joints to care for expansion, as I have seen, I think he would be delighted to see this method omitted in all piping and omitted in all lists of recommended methods of allowing for expansion. If there is a twisting movement in the joints of a pipe or fitting it is almost certain that a leak will result. In my own work I will not accept such a method of allowing for expansion, and unless expansion joints are called for, I have found it necessary to require a sufficient length of pipe so that the expansion may be taken care of exclusively in the spring of the pipe.

There is another point which I might mention in connection with this subject. This is the placing of what may be called a cold strain in the pipes. In other words, the pipes are so strained when cold that the lengthening due to expansion tends to remove either entirely or largely all strain in the pipes when hot. This method eliminates the strain of expansion from the pipes when hot and can often be used to great advantage.

I believe that I was the first to use this method of eliminating expansion strains. I have often used the same with great success in stopping leaks due to expansion strains as well as in connection with new work.

Very truly yours,
William J. Baldwin,
Consulting Engineer.
World Building, New York City, July 31, 1908.

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REVIEWS.

A New British Work on Sewage Disposal.

Reviewed by GILBERT T. FOWLER,* D. Sc., F. I. C.

THE DESIGN, CONSTRUCTION AND MAINTENANCE OF SEWAGE DISPOSAL WORKS.—By Hugh P. Raikes, Assoc. M. Inst. C. E., Assoc. M. Am. Soc. C. E. London: Archibald Constable & Co., Ltd. New York: D. Van Nostrand Co. and Engineering News Publishing Co. Cloth; 6 × 9 ins.; pp. 414; 72 illustrations. 16 shillings, net; American price, $4.

In the course of a conversation the other day with a very eminent New York engineer, the present reviewer was asked whether the relation had been definitely determined between the surface area of the particles of a sewage filter and the oxygen required for effective purification. A negative answer being given, the engineer rejoined, "Well, you see, in the meantime I have to design works."

These remarks would appear to indicate pretty accurately the present position of the sewage question, and in the cleverly condensed historical introduction to the book now under consideration the author shows that while the United States, and subsequently workers on the Continent of Europe, have been pre-eminent in experimental investigation, England, by the necessities of the case, especially by reason of large populations on the banks of comparatively small rivers, has been forced to deal with the problem by the expensive method of "trial and error." The conclusions reached by this method, expensive though it may be, are, however, of great practical value; indeed, many questions, apparently, can only be settled in this manner. Mr. Raikes's book, therefore, being the product of quite exceptional experience in the design and construction of works to meet varying conditions, should be especially welcome to all those whose experience in this direction has been necessarily more limited.

It should be remarked, in the first place, that the author writes as an engineer, for engineers, and expressly disclaims any authority as a chemist or bacteriologist. It is not reasonable, therefore, to criticise the book entirely from the point of view of the latter. At the same time, it is well to emphasize the fact that though no doubt in the end most organic debris finds its way to the "all-devouring microbe," yet the process is not so rapid or so simple (apart, at any rate, from the conditions obtaining in tropical countries), as the "man in the street" is prone to imagine, and a great many other factors, chemical, physical and biological, enter into the question. It is evident, from scattered passages, that the author realizes this; at the same time the paragraphs relating to bacteriology in the first chapter, though correct so far as they go, tend somewhat to confirm the erroneous impressions, above mentioned, and should therefore be read with caution.

Frequent reference is made throughout the book to the work of the Royal Commission on Sewage Disposal during the ten years since it was appointed, and a useful list of its reports is given in the introductory chapter. The real value of the prolonged investigations of this commission thus becomes apparent and Mr. Raikes does not make the mistake of certain critics who apparently expected from it some magical formula which should at once solve all difficulties. The real work of the commission has been in systematizing a large mass of information and supplementing it by authoritative work on the part of its own officials, and finally in making recommendations of great importance in relation to future progress. Mr. Raikes is a warm supporter of the proposed central authority for the control of rivers' pollution and water supply. Such an authority would have many of the functions of the State Boards of Health which have done such valuable service in America. It is hoped that the creation of such a central authority will form one of the proposals in a bill on the general question of rivers' pollution to be brought before Parliament at an early date.

Chapter I., on general preliminary considerations, contains a great deal of valuable matter. The list of particulars required by the Local Government Board in connection with sewage disposal works should facilitate those preliminary investigations upon the necessity for which the author very rightly insists. It is not difficult to point to cases where serious trouble has arisen owing to defective information having been supplied to the consulting engineer in the first instance, often because of the reluctance of authorities to spend a very small percentage of the total cost of the works in acquiring full data. Such preliminary investigations are, if possible, even more necessary in the case of sea outfalls, which form the subject of Chapter II., as, if an outfall is wrongly chosen it affects the whole sewerage of the town and may perpetuate a serious nuisance. Reference is made to what may be called the secondary effects of sewage discharge in the well-known case of the Belfast Lough, where immense growths of "Ulva Latissima" develop as a result of sewage pollution, and afterwards rot, giving off sulphuretted hydrogen. Such a trouble is very difficult to cope with, as the weed finds its nitrogen not only in raw sewage but also in oxidized effluents containing nitrate. The problem in Belfast, therefore, is to eliminate nitrogen as far as possible in the gaseous state by interaction of nitrates and unoxidized sewage matter. The case of Belfast has received very careful study on the part of Professor Letts; but similar trouble arises very often in inland streams owing to the growth of "sewage fungus," even when effluents of a considerable degree of purity are obtained. A very small leakage of unpurified sewage into a land drain, for example, will develop fungus even though the effluent as a whole is excellent. Much important work remains to be done on these lines and it is known that the subject is receiving the attention of the Royal Commission.

Chapter III. deals with land treatment. It is rightly stated that the quantities of sewage which can be treated on sandy soil in America, as given in a recent paper by Dr. L. P. Kinnicutt, cannot be approached in England. The author ascribes this to the much greater strength of English sewage. While this is undoubtedly a factor, the matter of climate, one ventures to think, is equally important. In the reviewer's experience loamy soil which in hot dry weather will efficiently purify quite a considerable amount of normal English sewage, becomes hopelessly inoperative during a long spell of rainy or damp weather. The striking experience of Birmingham, and it may be added the identical experience on a smaller scale at the Withington works of the Manchester Corporation, have shown that where large populations have to be dealt with much more satisfactory results can be obtained by what may be termed artificial methods than by land treatment. Land unsuccessfully used for purifying effluents finds entirely satisfactory employment in receiving the sludge which is delivered into trenches in the liquid state and afterwards dug in with the effect of raising and improving the land.

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*Consulting Chemist to the Rivers Committee of the Corporation of Manchester, England.

The suggestion of the author in a later chapter that land can be usefully employed for lagooning storm water does not recommend itself to the reviewer; the effect of running any considerable depth of sewage or effluent on to land or even on to filter beds is to produce a film of deposited matter which causes percolation to be extremely slow, with the consequence that the liquid is usually run direct into the river.

Chapter IV. deals with the removal of matters in suspension by screening and treatment in tanks. One might suggest that the subject of screening is treated somewhat perfunctorily. The technique of this question has received considerable attention in Germany and reference might well have been made to the ingeniously designed plants at Hamburg and at Frankfort. The difficulty, met with in most of the English designs, of the rapid wearing away of bearings beneath the surface of the sewage, is largely eliminated in these plants. A good deal of interesting work has also been done in Germany on the theory of tank design, a branch of the subject which has been somewhat neglected by English engineers, pre-occupied often with simple questions of cost. The author is certainly correct in stating that tanks whose length is considerably greater than their breadth give as a rule the best results and are to be recommended wherever possible. With such a form of tank it is much easier to realize the ideal conditions for sedimentation, namely, that the liquid should move forward as a whole. Carefully-arranged baffling walls or boards will also help towards this result. In fact the reviewer is aware of a case where baffling boards have been made adjustable to compensate for the varying density of the liquid, due to differences of temperature at different seasons of the year.

A description is given of the Hampton hydrolytic tank, designed to reduce to a minimum the amount of solids escaping after septic action. It has always appeared to the reviewer that the same result could be obtained by a much simpler design on the lines above indicated, and in fact practical experience with a very strong sewage has confirmed this conclusion.

Reference is made in this chapter to Mr. Dibdin's slate beds or tanks, but the author does not seem quite to have appreciated the real object of the process, which is so to change the sludge, which would otherwise accumulate in settling tanks, that it is no longer offensive in smell and can be readily drained and dried. The measure of success which this important object has so far obtained warrants, one ventures to think, the closer attention of engineers, the real point being not that a tank filled with slates is much more expensive than an empty tank but whether this increased cost is not more than compensated by the reduction in expenditure on sludge disposal by other means. The loss of head involved by this process has, of course, to be reckoned with, but there are many cases where this objection would not apply and where it is important to eliminate the risk of nuisance always present with septic tanks.

Chapter V. deals with chemical precipitation and disposal of sludge. There is a tendency at present in England to revert to chemical treatment with a view to saving expenditure on subsequent filtration of the effluent, so this chapter, therefore, by no means deals with ancient history. It may be recommended to the careful consideration of those who are contemplating what, in the opinion of the reviewer, must frequently be a retrograde step. Apart from special cases where everything must be sacrificed to economy of area, and where the disposal of sludge does not present any great difficulty (of which an excellent example is afforded by the case of Salford), it does not seem possible, arguing from first principles, that chemical treatment can be economically sound. To effect a marked reduction in suspended and more especially colloidal matters (which are often omitted from consideration), as compared with what is possible by simple sedimentation, very large doses of chemicals are needed, with consequent great increase in the quantity of sludge produced. Moreover, when this is done, the sewage has not been purified, but the impurities have merely been separated and have still to be dealt with. It is difficult to see that the money thus spent can possibly effect as much real purification as if it were capitalized into construction and maintenance charges for filter beds. The discussion must always come back to the question of sludge, and not only is the sludge remaining after purely bacterial processes much less in amount than that produced by chemical treatment, but it is much easier to handle and ultimately to render transportable, and possibly saleable.

Chapters VI., VII. and VIII. deal, respectively, with the character and preparation of filtering media, and with the construction and working of contact beds and of percolating filters. These chapters abound in useful practical suggestions and information. Some attempt is made to deal with the theoretical and practical considerations involved in determining the right size of fragments to employ, but, as already indicated, this still affords scope for prolonged research before anything like mathematical accuracy of design can be attempted.

Considerable space is devoted to recently devised plant for screening and washing filtering material, both during constructional work and after a prolonged period of use.

Chapter IX. is entirely devoted to the technic of the distribution of sewage in percolating filters.

The peculiar difficulties of the problem are set forth in a manner only possible after a varied experience, and, it may be added, not a little tribulation. The special experience of the author in connection with power-driven sprinklers at Hanley is described in detail. Even the cost figure given (some £43 per acre per annum), which is lower than earlier estimates, is yet considerable, and one is forced to question whether a greater result from the point of view of purification effected could not be obtained by extending the filtration area with the capitalized sum involved. Careful comparative tests to settle such a question would be of great interest.

The peculiar difficulties due to storm-water are well brought out in Chapter X. The whole question is one of those which it is almost impossible to deal with experimentally, apart from actual practical experience, owing to the fact that in most cases little or no fixed relation exists between the volume of liquid reaching the works and its composition. Any arrangement of fixed weirs will generally have the result that highly impure sewage will pass away imperfectly treated, even after only slight rainfall, if this should occur at the period of daily maximum flow. The difficulty, one feels sure, will have to be met on some such lines as are suggested by the author; increased provision of storage tanks, compensated by some reduction in the area of filter beds. The impurity in storm water is largely in the form of suspended solids, and if these are removed the remaining liquid can often be safely admitted to a stream, especially if the latter is in flood.

The necessity for further legislation on the vexed question of trade wastes is emphasized in Chapter XI. This necessity will not be disputed in view of the fact that in a quite recent case two appeals have been necessary to settle the definition of the word "sewer," and it has been decided that the word is intended also to cover disposal works. Not the least important result of the labors of the Royal Commission will, it is hoped, be legislation to clarify and systematize the varying opinions and practice in this connection.

The final chapter is devoted to works management. The author will be heartily supported in his plea for greater efficiency in this direction. Happily there are indications that the same development is taking place in regard to sewage works management as has occurred in connection with gas works and chemical works; and the steady progress made by the comparatively recently founded Association of Managers of Sewage Disposal Works augurs well for the future. It is becoming more and more recognized that for works of any size the manager must be a man of many parts, with a special technical training. Smaller works will probably need to be grouped under a single technical head. One cannot omit reference to the highly ingenious schemes described by the author for systematic control of the Hanley works, whereby flows can be read and samples drawn at any moment in a central office. It can only be hoped that such an object lesson will be successful, though one has fears of pipes and taps becoming clogged with sewage growths, and of other untoward happenings which appear inseparable from apparatus dealing with such necessarily uncleanly liquids as sewage effluents.

Finally, it may be repeated that this is a "live" book. Any differences of opinion which may be felt between author and reviewer are merely such as necessarily and usefully exist between workers in different parts of the same field. The practical man will find in its pages many useful "tips" and will be led to see where he can be helped by scientific investigation, whilst the scientific worker will be enabled better to realize the practical limitations which are often set to the ideal design indicated by theory.

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REPORT OF THE ROYAL COMMISSION, QUEBEC BRIDGE INQUIRY; also Report on Design of Quebec Bridge by C. C. Schneider.—Sessional Paper No. 154, 7-8 Edward VII., A. 1908. Printed by Order of Parliament. Ottawa: Paper; 6½ × 10 ins.; pp. 206; with illustrations and plates in the text and a separate volume of folding plates.

This highly important report has now been issued in printed form as a Parliament paper. The facts brought out by the Commission in the course of its inquiry are so numerous and complex as to make it certain that without an authoritative governmental investigation the whole story of the construction and collapse of the bridge would never have been revealed. The abstracts published in Engineering News, while they represent the leading features of its contents quite fully, were necessarily limited, and omitted a great amount of interesting detail found in the full report. Therefore the report itself, and especially the excellent series of maps and plans which accompany it, should be in the hands of every bridge engineer. It is to be noted, however, that the voluminous testimony given before the Commission, much of which was reproduced in Engineering News, is not printed in this report.

Mr. Schneider's report on the design of the bridge is a necessary supplement to the Commission's report. His full stress tables give an accurate picture of the design of the bridge. A full abstract of his report, and some editorial comment on it, which appeared in the Aug. 6 issue of Engineering News, makes more detailed reference to its contents in this place unnecessary.

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SOME PRINCIPLES UNDERLYING THE DESIGN OF SMALL SEWAGE INSTALLATIONS.—A Lecture Delivered before the Edinburgh Architectural Association on 27th March, 1907. By Gilbert J. Fowler, D. Sc. F. I. C., Consulting Chemist to the Manchester Corporation Rivers Committee, Lecturer in Bacteriological Chemistry, Public Health Department, University of Manchester. (Manchester, England: The Author.) Paper; 5½ × 8½ ins.; pp. 16; two plates. 1s. 6d.; American price, 60 cts.

The author first sets forth some of the special factors that must be considered in treating the relatively fresh and highly-concentrated sewage of houses and institutions. He then discusses the chemical transformation of the organic matter of sewage, as effected by the septic tank and by filter beds. Next he takes up problems of design. The subject is presented clearly throughout. The pamphlet will be of interest and value to many having to do with large as well as small installations, since it embodies some of the results of a large and varied experience in sewage treatment.

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Studies of the Hydraulic Ram.

AN INVESTIGATION OF THE HYDRAULIC RAM.—By Leroy Francis Harza. Researches in Hydraulics, by Daniel W. Mead, Professor of Hydraulic and Sanitary Engineering. Bulletin of the University of Wisconsin, No. 205. Madison, Wis.: The University. Paper; 6 × 9¼ ins.; pp. 111; one folding plate and numerous text illustrations. 25 cts.

The investigation herein described is an attempt to put the design of the hydraulic ram on a rational basis. Although the ram has been in use for over a hundred years it has received little attention from engineers, and it has generally been considered suitable for pumping only small amounts, where efficiency is not of great importance. It has frequently been shown, however, in actual test, to give an efficiency in the neighborhood of 70% when the conditions were favorable, a figure far in excess of that given by any other available means for pumping small quantities of water, and much better than that shown by ordinary centrifugal pumps. The possibility of high efficiency has always been present in the ram, but no one has shown how to design the ram itself and to fix its external conditions, such as the length and diameter of its supply pipe, so as to obtain this efficiency in practice.

Mr. Harza has not completely solved the problem, for, as he says, the research is far from being finished, but he has made a long step towards its solution. His method is admirable. He tackles the theory of the ram first, and with several pages of most formidable mathematics he reaches certain formulas for two efficiencies, first that during the acceleration period, when the water is flowing with increasing velocity in the supply pipe, and second that of the retardation period, after the closure of the waste valve. The product of these two efficiencies is the total efficiency. The two formulas are, respectively:

$$E = \frac{v^2 l}{2gsH} \text{ and } E_1 = \frac{2gSh}{lV^2} \times$$

These formulas are innocent-looking, until we examine their notation, viz., V = velocity of water in the drive-pipe at time t; l = length of drive-pipe; $g = 32.2$; H = supply head; S = distance moved by the water column in the drive pipe in time t after opening or closing the waste valve

$$= \sqrt{\frac{H}{m}}\left[\frac{2}{j}\log_e\left(\frac{1+e^{jt}}{2}\right) - t\right]; \; j = \frac{2g\sqrt{mH}}{l},$$

and m is the sum of several quantities representing frictional and other losses. The second formula is still more of a terror, for S has four different values for as many cases. This part of Mr. Harza's work may be commended to those who like to wrestle with tough problems in calculus and applied mechanics.

Having obtained his formulas the author now tests their value by a series of experiments on a ram under different conditions. He enumerates twelve conditions that may be varied independently, such as supply and pumping heads, length and size of drive pipe, time the waste valve remains open, rate of closing it, etc.; and four things to be recorded by autographic devices, viz., velocity of flow in the drive-pipe, pressure in the drive-pipe, motion of the waste valve, and time. The experimental work, therefore, was about as complex and difficult as the mathematical. The results of the tests which, as Mr. Harza says, were too few in number, are given in numerous tables and diagrams. On the latter, together with points representing the actual results, are plotted curves derived from Mr. Harza's equations. These curves are in general higher than the actual results, and considerably higher in case of low efficiencies, due to lack of experimental bases for some of the constants used in the formulae, and other causes explained in the texts, but they show a general agreement in form and direction with the location of the plotted points, and a surprisingly close agreement in position for the higher efficiencies. Mr. Harza has not made a brief tabular summary of the results, so the reviewer has compiled the accompanying, taking approximate figures from the curves. The supply head in all the tests was a little over 8 ft.; the length of drive-pipe was 85 ft. in one set of tests and 51 ft. in the other. The pumping head varied as shown. V, in the table, is the velocity of the water in the drive-pipe in feet per second. The first column of efficiencies shows the maximum obtained for the given pumping head; the second the maximum theoretical efficiency, according to the curve, and the velocity corresponding to it. The remaining columns show the actual and the theoretical efficiencies corresponding to velocities of 3 and 4 ft. per second.

It appears from these figures and from the curves from which they are derived that the prime condition for maximum efficiency of a ram, within the range of the experiments described, is that the velocity in the drive-pipe shall be about 2 ft. per sec. The efficiency falls off rapidly with velocities less than 1 or more than 4 ft. per sec. A set of curves for the following conditions: length of drive-pipe, 85 ft.; supply head, 8 ft; pumping head, 12 ft., shows that maximum capacity, 4 gals. used per min., was obtained with 25 gals. used per min, 20 strokes per min., 4½ ft. per sec. maximum velocity in drive-pipe, and 35% efficiency, while the highest efficiency, 68%, was obtained with 1 gal. pumped, 4 gals. used and 70 strokes per min., and maximum velocity in drive-pipe 1.2 ft. per sec.

As to the effect on the efficiency of the several variable conditions it appears: The efficiency of the ram is increased by increasing the supply head; is decreased by increasing the pumping head; is decreased by lengthening the drive-pipe, except perhaps for short drive-pipes and low velocities; is increased with rapid valve closure and with the use of a large air chamber. The waste valve should be as light as is convenient with strength and durability, and it should be held open with a long spring rather than by a weight. The necessary valve area should be obtained by a number of small valves rather than by a large valve. It is the belief of the author that the comparison of theory and experiment has demonstrated the practicability of the logical design of a hydraulic ram for any given working conditions. Certain constants entering into the formulae, however, yet require experimental determination.

The author discusses the two formulas for defining what is meant by the efficiency of the hydraulic ram, viz., Rankine's $E = \frac{qh}{Qh}$, and D'Aubuisson's $E = \frac{q\,(h + H)}{(Q+q)\,H}$, concerning which there has been some controversy, and prefers the former for his purpose. In these formulas, q is the water delivered by the ram and Q that escaping through the waste valve. H is the height of the water surface in the supply tank above the level of the waste valve and h the length of the water in discharge tank above the level in the supply tank. The author's reasons for preferring the Rankine formula are not altogether convincing, and he does not show that the D'Aubuisson formula gives the true efficiency of the ram as a machine, viz., the quotient of output by input, the ram receiving the energy $(Q + q)\,H$, and delivering $q\,(h + H)$ while Rankine's may be considered as giving the available efficiency of the plant, which is less than that of the machine because the quantity q which is delivered is not elevated directly from the supply tank to the discharge tank as it would be by a pump, but is used as part of the operating water and is then lifted from the lower level. The difference between the two formulas is shown by the following example: Two rams of equal efficiency, 70%, by D'Aubuisson's formula, $h \div H$ being 2 for one ram and 10 for the other, give respectively 60.86 and 67.96% by Rankine's. Whenever the efficiency of a ram is given it should be stated which formula is used.

Mr. Harza's investigation is, no doubt, one of the most scientific that has ever been made of the hydraulic ram, and it is to be regretted that he has not had the opportunity to make the experimental part of it more extensive.

Length of drive-pipe, ft.	Pumping head ft.	Actual Max. Effy. at V =		Theor. Max. Effy. at V =		Effy. at V = 3.		Effy. at V = 4.	
						Actual.	Theor.	Actual.	Theor.
85	12	64	2	70	1	48	55	33	42
"	23	64	2.4	68	2	53	61	40	50
"	44	64	2.4	64	2.5	55	62	43	52
"	63	59	2.4	55	3	55	55	45	50
51	13	63	1.5	68	1.3	50	59	42	50
"	24	66	2.[illegible]	66	2	55	62	47	56
"	46	61	2.5	61	2.7	50	61	52	57
"	65	58	2.3	54	2.5	55	54	51	50

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MEAT AND FOOD INSPECTION.—By Wm. Robertson, M. D., Medical Officer of Health, Leith, Author of 'Practical First Aid,'' etc. With Regulations Governing Meat Inspection in the United States, by Maximilian Herzog, M. D., Professor of General and Comparative Pathology in the Chicago Veterinary College. Chicago, Ill.: W. T. Keener & Co. Cloth; 5¼ × 8¼ ins.; pp. 372 + 16; 40 illustrations in the text. $3.50 net.

Besides detailed instructions for the inspection of meat, fish and various foods, this book has a few chapters on cow sheds, pigsties, etc., the public milk supply, slaughter-houses and other allied topics. For the most part the book relates to British conditions.

◆

CAST-IRON HOUSE DRAINAGE.—With Especial Reference to the Drainage of Town Houses. By Gerard J. G. Jensen, Author of "Modern Drainage Inspection and Sanitary Surveys," etc. London, England: The Sanitary Publishing Co., Ltd. Cloth; 4¾ × 7½ ins.; pp. 206; 185 illustrations in the text. 4s. 6 d.; American price, $1.80.

After advocating the use of cast iron as material for use in house plumbing and drainage, the author proceeds to describe British practice in plumbing, confining himself chiefly but not solely to cast-iron pipe specials and various fittings. From the British standpoint, and within the limits indicated, the book appears to be a satisfactory one.

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Earthwork Computations.

Reviewed by CHARLES L. CRANDALL.[*]

METHODS FOR EARTHWORK COMPUTATIONS.—By C. W. Crockett, Professor of Mathematics and Astronomy, Rensselaer Polytechnic Institute. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth: 5¼ x 9¼ ins.; pp. 114; 90 illustrations in the text. $1.50, net; English price, 6s. 6d., net.

The author assumes for the general earthwork solid a figure having planes or hyperbolic paraboloids for its longitudinal faces and parallel-plane cross-sections for its end faces, these end sections being determined in the usual manner by levels and horizontal distances. These longitudinal faces intersect in straight lines, the two intersections for a hyperbolic paraboloid forming the directrices, while the generatrix moves along them parallel to the end sections in generating the surface.

Vertical planes are passed through the longitudinal edges and extended down to meet a horizontal reference plane through the lowest vertex. This divides the solid below the upper faces, and also that below the lower faces, into trapezoidal prismoids in which any end face may reduce to a triangle or to a vertical line. The prismoidal formula is assumed to give the true volume for each of these prismoids, while the sum of those below taken from that of those above the original solid will give its total volume. This process requires, under Rule 1, two products of four factors each for each longitudinal edge.

Sixteen pages are devoted to special cases and to problems under Rule 1. The general railroad earthwork solid is then taken up and rules derived for irregular, three-level and five-level ground, borrow pits, side hill work and end sections, extending the number of rules to thirteen and the text to forty pages.

The method by averaging end areas for the general solid, and for railroad work, including irregular, three and five-level ground, side hill work and level sections, is taken up in Chapter II. The prismoidal correction to be applied to the result found by averaging end areas in order to obtain the true volume is derived in Chapter III.

Chapter IV. takes up preliminary estimates for railroad work where the center heights and transverse slopes are given.

The correction for curvature is taken up in Chapter V.

Chapter VI. takes up the Crockett volume slide rule, a circular cardboard-disk slide rule some 15 ins. in diameter and carrying five different scales. The greater accuracy due to the longer scale, about 47 ins. for the outer and 39 for the inner, as compared with the ordinary slide rule, would be offset in part, at least, by the rotating pasteboard disk and the use of a celluloid arm to project across the 1¼-in. or larger, space from the rotating to the fixed scales. The combination of the constant to reduce to cubic yards in the graduation of three of the scales would slightly reduce the labor of setting.

In the appendices the prismoidal formula is derived for the assumed trapezoidal prismoid, approximate methods of applying the correction are given for railroad work, and the book closes with a summary of the notation and rules for the different cases considered.

The book as a whole presents the subject of the computation of earthwork quite clearly and fully. The rules derived could be more readily understood by the student if expressed in words as well as by formulas, as the notation used in some of the special cases is not evident even by reference to the summary. In general, however, the statements are clearly made and the methods easily followed.

There are many who will not accept the slide rule, Crockett or common, as giving satisfactory results except for very light work. This may be due, as the author intimates, to a lack of appreciation of the limits of accuracy attained in cross-sectioning, but in many cases it is due to a desire to have the computed results check accurately with the field data.

The formulas given, however, are available for computation by accurate methods or by the Thatcher slide rule or a computing machine.

The formulas which will be used for sections taken by levels are those for the average end-area method and usually without the prismoidal correction. In this case one product for each cross-section for irregular ground can be saved by including the grade triangle and finding the area by J. Woodbridge Davis' method.[*]

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Gas Piping and Lighting.

THE AMERICAN PRACTICE OF GAS PIPING AND GAS LIGHTING IN BUILDINGS.—By Wm. Paul Gerhard, M. Am. Soc. M. E., Consulting Engineer for Hydraulic and Sanitary Works. New York: McGraw Publishing Co. Cloth; 6 x 9½ ins.; pp. 306. $3, net.

It is the author's stated intention to take up the subject of gas installations at the point where the supply reaches the consumer's premises. The expressed purpose of the book is to furnish the ordinary householder with much information which he would not be expected at the present to possess—or possibly care about. For such persons, probably a half of the book will be a little too technical and too tedious to hold his attention until he gets well into the back half and finds there the general hints, suggestions and discussions which he can more readily grasp.

That there are 27 chapters in a small book, like this, of itself indicates that the author has split the matter up into more subdivisions than would seem absolutely necessary. The independent arrangement of the subject matter of most of these chapters and the large number of repetitions seems to indicate that the book is more a compilation of engineering essays than anything else. That, however, does not indicate that there are not many data and specifications of interest and value to the engineer, architect and builder. The amount of quoted matter is remarkable, adding up to some 90 pages—nearly a third of the book. In many cases these pages are tables and rules of practice of certain concerns, but too often they are reprinted newspaper editorials, stories, etc., which, by omission, would make the book more valuable to engineers.

Those chapters of greatest interest to engineers are on (1) the arrangement of gas pipes in buildings, (2) specifications, tables, rules and regulations of companies in regard to piping generally, (3) piping systems for coal, water, natural, air and acetylene gases, (4) testing of piping installations, (5) burners, (6) pressure regulators, (7) globes and holders, (8) fixtures, (9) bibliography. The chapters more easily read by laymen are on topics like prejudices against and fallacies of using gas, advantages of gas as an illuminant and for heat and power, gas meters and gas-meter stories, interior illumination, lighting of country houses, relations of gas companies to consumers, practical hints for consumers, accidents and dangers to public health.

In the chapter on the arrangement of pipes in a building, the proper and the common grades of pipes and fittings are discussed and compared. Particular stress is laid on the faults of present methods of piping and suggestions are made for better layouts. The present practice, according to the authorities Mr. Gerhard cites, is to run a main from the meter to some central point for the whole house and from there to run a single central riser from which feeders are led out for the different floors. The recommended layout would have an individual branch, for each important part of the buildings, running direct from the main to the feeders for that part.

The method of testing the tightness of a pipe installation by an air pump and mercury column is given and the method of locating leaks with ether and soap-suds. The practice of seeking out leaks with a flame is, of course, strongly disapproved.

The chapter on gas burners classes the various kinds as (1) simple-jet, (2) flat-flame, (3) round or Argand burner, (4) regenerative, (5) incandescent. The construction and performance of a number of types and makes are described.

In the proper chapters, as enumerated, the general utility of gas globes, the faults of older types of globes and shades, the necessity of having better mechanical designs of fixtures and the construction and faults of "wet" and "dry" meters are rather generally sketched.

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GEOLOGIC ATLAS OF THE UNITED STATES.—U. S. Geological Survey, Charles D. Walcott, Director. Washington, D. C.: Pub. Doc. Stiff paper; 18½ x 22 ins.

No. 157: Passaic Folio. New Jersey-New York. Pp. 27; 5 plates and 26 text figures. 25 cts.

Inasmuch as this folio relates to a portion of New York City and the section of New Jersey just across the river therefrom, it promises to be of interest to a large number of engineers. The folio, which has been prepared in conjunction with the Geological Survey of New Jersey, includes the counties of Union and Essex and portions of six other counties. The area dealt with within New York City includes all of the Borough of Richmond (Staten Island) and parts of Brooklyn and Manhattan. In New Jersey the cities of Newark, Hoboken, Jersey City, Paterson, Elizabeth, Passaic, Plainfield, Rahway and Perth Amboy are included. The text deals with the descriptive geology, geological structure and economic geology of the district, and also (but briefly) with underground water. There are a topographical map and several geological maps. One of the latter shows cross-sections of the geology of the quandrangle. A few well-chosen half-tones are included, besides a number of line drawings.

◆

TELEPHONE LAW.—The Organization and Operation of Telephone Companies. By A. H. McMillan, Legal Editor of "American Telephone Journal," Member of the Bay City, Mich., Bar. New York: McGraw Publishing Co. Cloth; 5¾ x 8½ ins.; pp. 331; $3, net.

Intended for telephone men, rather than for lawyers, this volume contains a large amount of orderly-arranged material on the private and public phases of telephone law. Numerous citations of cases appear. The book is the result of the editorial work of the author (see headpiece). The preface is dated April 9, 1907.

Telephone Construction,
Methods and Cost

This book is by all odds the most complete and systematic record of costs for any one class of construction work that has ever been published. Its author is Clarence Mayer, formerly Cost Statistician and Facilities Engineer, Chicago Telephone Co. The book covers pole line construction, cable construction, underground construction, etc. Send for pamphlet giving table of contents and sample pages.

The book contains 300 pages, and its price is $3.00 net, postpaid.

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[*] Professor of Railroad Engineering and Geodesy, Cornell University, Ithaca, N. Y.

[*] See his "Formulas for Railroad Earthwork," 1873.

Mechanical Engineering for Mechanics.

STATIONARY ENGINEERING.—A Reference and Text Work Written Expressly for Stationary Engineers and Firemen; also Mechanical Engineers, Consulting Engineers, Electrical Engineers, Universities and Schools. By Joseph G. Branch, M. Am. Soc. M. E., Author "Heat and Light from Municipal and Other Waste," etc. In Three Volumes. Chicago and New York: Rand, McNally & Co. Cloth; 5¼ × 8 ins.; $2.50 per volume; $7 for complete set.

Vol I.: Steam Boilers and Attachments. Pp. 393; 126 illustrations in the text and 11 tables.

Vol. II.: Heating, Steam Engines, and Electricity. Pp. 373; 124 illustrations in the text and 10 tables.

Vol. III.: Elevators, Mechanical Refrigeration and Steam Turbines. Pp. 273; 70 illustrations in the text and 15 tables.

In something over a thousand pages, Mr. Branch has built up a small library on what he has chosen to call "stationary engineering," but which many people would term "practical mechanical engineering." The limitations and the field of the work are clearly apparent when the author states that it is "written expressly for engineers and firemen." The three volumes have much to recommend themselves, on examination, as to their fitness to be put into the hands of intelligent mechanics. Several criticisms might be made, although the points involved are of minor importance. There are a number of typographical and grammatical slips, a few expressions that might be better chosen for their readers and an occasional illogical sequence of topics. The method of presentation is largely descriptive and wholly non-mathematical. The exposition of each important topic is followed by a series of questions and answers involving the salient points of what precedes. The liberal use of chapter headings and heavy side heads renders the volumes somewhat more accessible for ready reference.

All of Vol. I. and some 75 pages of Vol. II. are on boiler practice. The rest of Vol. II. is largely given over to steam engines, pumps, dynamos and motors. The last volume of the series takes up elevators, refrigeration, the steam-engine indicator, hoists, boiler inspection, the licensing of engineers and firemen and steam-turbine practice. This last volume is not quite as carefully arranged as the preceding ones; close examination fails to disclose why the steam-engine indicator should be taken up between elevators and mechanical refrigeration or why the matter on the steam turbine should be so far removed from engine and boiler practice.

The treatment of boiler practice is extensive and includes the history of boiler development, descriptions of modern types and makes, requirements of iron and steel for boilers, attachments, etc. What is meant by boiler horse power, heating surface, equivalent evaporation, efficiency, and all such terms is simply explained. In the sub-division on "combustion" the common fuels are described and the fireman is set right as to what constitutes "smoke prevention" and as to the necessity of securing complete combustion. Good boiler management is outlined by explaining the necessity of cleaning both water and fire sides of metal and by telling what procedure is necessary in putting a boiler into, or taking it out of, active use.

The arrangements of apparatus and piping for the numerous steam-heating systems are described by the aid of diagrams. Boiler practice is concluded with specifications for low pressure and central heating plants, insurance inspection rules and the code of the American Society of Mechanical Engineers for boiler trials. The latter is abridged and has an explanatory chapter.

The growth of the steam engine is briefly shown by reference to the work of Savery, Newcomen and Watt. The different kinds of modern engines and the functions of their various parts and accessories seem to be adequately described.

The principles underlying the more familiar phenomena of electricity and their application to dynamo-electric machinery are expounded as simply as would seem possible. In only one place is a statement noted which might be confusing and misleading to the average reader for whom the book is intended. This is where the author states:

> Electricity is transmitted over the surface of a body and not through the interior as is heat and light. The interior of a conducting body can be made hollow or even filled with a non-conducting material and it will have no effect upon its conductivity.

Comment is superfluous.

The third volume, exclusive of the minor topics already mentioned, is an elementary treatise on elevators, mechanical refrigeration and steam turbines. In the first-named subject the common forms of freight and passenger elevators are described and practical suggestions are made on the care of the machinery.

In discussing mechanical refrigeration, the author names four classes of physical actions through which heat is absorbed from one substance by another. The ammonia expansion system is well described as are the methods of distributing the cooling liquid about a chamber in brine pipes and the various ice-makng machines.

In the section on the steam turbine, after rather generally dealing with the actions involved in changing steam under pressure to steam at high velocity, the actions of the De Laval, Curtis and Parsons types are outlined.

If any engineer has in his employ an engine runner or a fireman who is doing good work and is capable of doing still better work, so that it seems desirable to commend and encourage him, the presentation of this little library ought to meet the demands of the situation.

◆

HOW TO BECOME A COMPETENT MOTORMAN.—A Practical Book on the Proper Method of Operating a Street Railway Motor-car; with Instructions How to Overcome Troubles on the Road. By Virgil B. Livermore, Inspector, N. Y. C. & H. R. R. R., and James R. Williams, Mechanical Expert Department, Galena-Signal Oil Co. Second Edition, Revised. New York: D. Van Nostrand Co. Cloth; 4½ × 6¼ ins.; pp. 247; 60 illustrations, mostly in the text. $1, net.

This book is intended solely for the improvement of motormen as employes of the traction companies. To this end there is little theory but much of information as to the construction and operation of electric cars. The little presentation of theory is related to the attraction and repulsion of magnets and to the definition of the electrical quantities—volt, ampere, ohm and watt. The authors give a very brief description of a typical street-railway motor. A little more than a quarter of the book is given up to descriptions of the more common Westinghouse and General Electric controllers, in the course of which the circuits for each step of the controller handle advanced are given. There is a good section on "what to do in case of trouble" and on locating the various troubles that occur in brakes, motor and control equipment.

About a fifth of the book is on the important subject of air brakes. Here are described briefly the essential features of all the better known makes, and then gives instructions for operating the Christensen, Merritt and Westinghouse apparatus. Track signals have their place and the book closes by reprinting the standard rules of the Street Railway Association of the State of New York for the guidance of employes operating surface cars.

◆

A Catechism of Electrical Theory.

CONVERSATIONS ON ELECTRICITY.—By Joseph G. Branch, M. Am. Soc. M. E., Author "Heat and Light from Municipal and Other Waste," etc. An Elementary Work Written Expressly for Engineers and Students. Part I. Chicago and New York: Rand, McNally & Co. Cloth; 5¼ × 8 ins.; pp. 282; 96 illustrations in the text. $2.

Mr. Branch, in his "Conversations," has arranged what he has chosen to call "An elementary work for engineers and students." It may be a suitable book for mechanics and apprentices but it will not be very satisfactory to engineers—as the term is properly used. The volume is, in fact, an excellent elementary catechism. There are a few passages where the author, in seeking the simplest presentation, has allowed the possibility of misinterpretation which the student may follow to an erroneous conclusion. The reiteration of primary ideas from several standpoints well emphasizes the essential points.

The subjects of static and dynamic electricity are first considered (the older meaning of these terms being retained) and then the elements of energy, work and power. "Voltaic cells" leads up to "the electric circuit," and then the author jumps to magnetism and electro-magnetism. The common electrical units and measurements are inserted before the questions and answers on Faraday's work with induced currents. This latter part serves as an introduction to mechanical generation of e. m. f.'s and electric currents and to direct and alternating-current apparatus—generators, transformers and motors.

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OFFICIAL YEAR BOOK OF THE COMMONWEALTH OF AUSTRALIA.—Containing Authoritative Statistics for the Period 1901-1907, and Corrected Statistics for the Period 1788 to 1900. Published under the Authority of the Minister of Home Affairs, by G. H. Knibbs, F. R. S. S., Commonwealth Statistician. Melbourne, Australia: Pub. Doc. Boards; 6 × 10 ins.; pp. 931; maps and diagrams in text.

A great variety of information is here given regarding this Commonwealth and its several States. The form of government, population, vital statistics, land tenure, agriculture, forestry, mines and mining, water conservation and irrigation, commerce, railways and shipping, finance and other subjects are treated in detail.

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THE WATER POWERS OF WISCONSIN.—By Leonard S. Smith, C. E., Engineer Wisconsin Geological and Natural History Survey, Engineer U. S. Geological Survey. Bulletin No. XX., Economics Series No. 13, Wisconsin Geological and Natural History Survey, E. A. Birge, Director. Madison, Wis.: Pub. Doc. Cloth; 6½ × 10 ins.; pp. 354; 54 plates and 17 text illustrations.

This is a descriptive and statistical account of the water powers of Wisconsin. The U. S. Geological Survey has cooperated with the State

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authorities in making a start toward surveying the rivers of the State. In addition, the compiler has drawn on the stream-flow data collected by the Survey. The publication is creditable to all concerned and will doubtless aid in the further development of the water powers of the State.

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The Steam Turbine.

Reviewed by CHARLES E. LUCKE,* M. Am. Soc. M. E.

THE STEAM TURBINE.—By Robert M. Neilson, Assoc. M. Inst. M. E., Chief of the Technical Department at the Hartlepool Works of Messrs. Richardsons, Westgarth & Co., Ltd. Fourth Edition, revised and enlarged. London, New York and Bombay: Longmans, Green & Co. Cloth; 5¾ × 9¼ ins.; pp. 604; 383 illustrations in the text and 50 plates. $4.20, net.

To those readers who dislike mental effort this book will probably appeal, especially if a desire for accurate, precise information be absent. The work is concerned principally with descriptions of several different turbines, a number of steam-turbine power plants and steamships driven by turbines, to which description is added the oft-repeated history of the turbine, and some material, supposedly the scientific explanation of turbine operation. The whole presentation is weak and ineffective for the needs of engineers or students of engineering. It might serve very well as an introduction to the subject, but even for such a purpose is too voluminous. What is said could have easily been condensed into half the space. It might also be useful to patent lawyers and poorly-informed inventors, but to the engineer who is interested in the steam turbine as a heat transformer, a machine that generates power from the heat in steam and is capable of performing certain classes of work, and who is desirous of knowing all the quantities involved, this book is a disappointment.

The history of the turbine is given in 54 pages, and the types there explained are divided into various classes, with a superficial comparison, in 23 pages; the construction of the commercial machines occupies 214 pages; some steam-turbine stations are given in 37 pages and ship propulsion in 54 pages; so that a total of 382 pages or nearly 70% of the book is devoted to ordinary descriptions of no very great value to the engineer.

Descriptions may be useful, and extremely so if they include analysis of conditions and analysis of structures to show the adaptability to the conditions, with reasons why things are as they are, and if afterwards conclusions are drawn and laws laid down valuable for future application. Such descriptions as are here given, however, are not of this kind and are of little value beyond historic record of something that has been done, offering practically no assistance to the structural engineer who must face new problems which preclude the copying of old or existing constructions. The chapter headings and division of the rest of the subject matter of the book look promising at first glance, but the material that a well-informed person would expect to find under those headings is absent, whereas much important connecting material is not even mentioned.

In the first chapter, under Fundamental Notes and Definitions, the turbine is defined as a machine in which rotary motion is obtained by the gradual change of momentum of a fluid. Formulae are set down for the forces acting on the vane in terms of initial and terminal velocity of the steam passing and trigometric functions of the vane angles. A further discussion of this relation, constituting really the kinematics of the steam and vane motions, with assumed values for velocities, is given in Chapter VI. and is entirely academic in character, as the author in no place mentions what vane angles are used in turbines, nor what velocities are ordinarily employed, nor what fractional velocities in multi-stage turbines for each stage, nor their distribution with load on the machine, nor the losses due to friction, clearance, leakage and similiar important causes.

Associated with such kinematic discussion, a reader might naturally expect a treatment of the velocities that might be obtained by expanding steam in nozzles and of the quantity of steam per square inch of nozzle section. Of the latter question, one of prime importance in turbine work, there is not a single word. Of the former there is some treatment, although it is extremely superficial. Such as there is is found in Chapter III., entitled The Conversion of the Heat Energy of Steam into Kinetic Energy, the whole being treated in 17 pages. This chapter contains a statement of equivalence of kinetic energy to the difference between total heats of steam before and after adiabatic expansion, and curves are given for the resultant velocity of steam, dry and saturated, expanding between various pressures. The values of these curves are, however, seriously impaired by their small scale. Pressures are plotted about 145 lbs. per sq. in. per inch of scale and velocities about 1,100 ft. per sec. per inch of scale, so that the use of such curves for velocity computations is practically rendered impossible.

There is a brief statement of the available energy for superheated steam, and resultant velocities, which is quite useless because there is no discussion of the specific heat of superheated steam, recent determinations of which have filled the technical journals and society transactions. These are entirely ignored, and the total heat of superheated steam is a question not touched on by the author at all. This is particularly significant in view of the fact that so many of the turbines are operating with superheated steam. It would be desirable, after giving a complete discussion of the laws controlling the quantity of flow through nozzles, the laws of expansion and velocity in nozzles and the kinematics of steam and vane movements, to discuss those losses which tend to effect the computations on the quantities and evaluate them. It is this sort of treatment that forms the particular features of the book by Professor Thomas,* and this is what one might expect from the heading of Chapter V., on Losses and Efficiencies. The early part of the chapter is, however, concerned with defining a variety of quantities of which eight are various kinds of efficiencies. For example, overall efficiency, thermal efficiency, nozzle, bucket, stage, effective, rotation and practical efficiencies.

To these are added the definitions of bucket work, efficiency ratio and jet kinetic energy. These various efficiencies are somewhat bewildering, but if by specific application good reason can be shown for their derivation they might be entirely justified. The author, however, makes absolutely no use of them and leaves the subject in the same speculative, contemplative state as some of the other chapters. This chapter on Losses and Efficiencies is concerned entirely with the nature of the losses and not at all with the quantity of the losses. It is qualitative rather than quantitative in nature, and all the valuable experiments and earnest attempts to evaluate these efficiencies and losses are ignored. Although part of the treatment would seem to indicate that the author was about to calculate thermal efficiency of a turbine in terms of the conditions which affect he fails to do so. Yet there is a 28-page treatment in Chapter XIV., of The Effects of Steam Pressure, Superheat and Vacuum, together with a 12-page treatment, in Chapter XVI., of Steam Consumption Tests. This part on steam consumption consists principally of tabulated tests collected from various sources, without adequate explanation, having no relation in the test to the design and dimensions of the machinery nor to the thermodynamic possibilities nor to the other controlling conditions, while the treatment of superheat, vacuum and steam-pressure influences is, like former chapters, functional and qualitative entirely. The author states what the nature of the effect of raising or lowering the pressure is, but fails to show rigorously why and how much.

In conclusion, the best that can be said of the book is that it is pleasant and easy reading for an engineer and may satisfy the curiosity of those poorly informed on this topic.

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18th Edition, 90th Thousand, 1907, $[illegible]

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DRAWING INSTRUMENTS.—Their Use and Abuse. By Walter G. Stephan, M. E. New York: McGraw Publishing Co. Cloth; 4½ × 7½ ins.; pp. 111; [illegible] illustrations in the text. $1, net.

This book gives clear and careful instructions for the proper use of drawing instruments. It will prove interesting to all engaged in the actual work of drafting, and is of especial value to beginners. Besides the ordinary drawing instruments, there are treated the slide rule, the planimeter, and the universal drafting machine. A chapter telling how to purchase instruments gives simple methods of testing the accuracy of all those commonly used.

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ELEMENTS DE RESISTANCE DES MATERIAUX APPLIQUE AU BETON ARME.—By R. Séguéla. Paris, France: Ch. Béranger. Paper; 6½ × 10 ins.; pp. 126; text illustrations. 7½ francs; American price, $2.25.

Allowing for the inability of the continental engineer to express any mathematical subject in simple terms this book answers its announced purpose of presenting methods of rapidly calculating those kinds of reinforced-concrete work that are found in ordinary practice. The methods given are not new but they are very complete and are presented in a systematic manner. However, there are a number of books on

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*Professor of Mechanical Engineering, Columbia University, New York City.

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the English language which should be more advantageous to the American engineer, even though he has the ability readily to read technical French and to wade through interminable mathematical processes. To the text-book writer and theoretician the complete treatment should form a valuable reference.

◆

Irrigation.

Reviewed by F. W. HANNA.*

PRACTICAL IRRIGATION.—Its Value and Cost. With Tables of Comparative Cost, Relative Soil Production, Reservoir Dimensions and Capacities, and other Data of Value to the Practical Farmer. By Aug. J. Bowie, Jr. New York: McGraw Publishing Co. Cloth; 6 × 9½ ins.; pp. 232; 53 illustrations in the text and 74 tables. $3, net.

Although the book under review purports to be a general treatise on practical irrigation, it does not cover the entire field of that subject and treats the portions of the field covered by it with unequal completeness. A volume covering the subject thoroughly from the viewpoint of the title of this work would be several times as large as this book. The material included in the book, however, is well presented and is either of technical or of elementary didactic value. It contains 16 chapers, well supplemented with tables and figures, mainly scattered throughout the text; and at the close of the book are two appendices containing formulas and tables relating to the economic capacities and construction of artificial reservoirs.

Chapers 1 to 7 deal in a brief and more or less elementary manner with some of the broad features of irrigation and the remaining nine chapters deal almost wholly with irrigation pumping plants and the construction of artificial reservoirs. In fact, the discussion of these two features of irrigation from the standpoint of the engineer forms the valuable portion of the book. The book contains very little information concerning irrigation farming, although its title might be taken to indicate otherwise.

The law of flow of wells is so treated as to invite careful reading and the theory and economy of pumping irrigation water is discussed in a comprehensive manner. In the treatment of the subject of wells and pumps the author has drawn freely from the matter published in separate No. 6 of Bulletin No. 158 of the Office of Experiment Stations, U. S. Department of Agriculture.

The author's insistent treatment of artificial reservoirs should be given careful consideration, as their economical use can be greatly extended. Artificial reservoirs are usualy of small size and may be constructed in the vicinity of the land to be irrigated. They are, therefore, especially applicable to pumping schemes and to small irrigation developments. Naturally thus far most of the small gravity irrigation schemes have been developed by individuals and small corporations; and the larger most feasible gravity projects have been developed by large corporations. The time is, therefore, close at hand when artificial storage reservoirs and pumping plants will be essential to the majority of developable projects. The small artificial reservoirs and tanks so little used in this country have long been successfuly used in India, and as the value of land increases and as irrigation becomes more profitable they will rapidly multiply.

Undoubtedly one of the most essential features of the construction of any irrigation system is advance knowledge of its approximate cost and efficiency. Lack of such information in connection with the development of any irrigation system has resulted in great financial loss and failure. Throughout the entire work the author has given cost data relative to irrigation and irrigation works. These data are necessarily approximations and should be used with this point clearly in mind. Farmers as well as engineers will, however, find the data of great value in making rough estimates by taking proper precautions regarding conditions affecting costs.

From the viewpoint of the agriculturist the en-

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tire work will be found of practical benefit, and from the viewpoint of the engineer the treatment of pumping systems and of the artificial reservoirs will be equally valuable. The author has spent much labor in the compilation of numerous tables and they will undoubtedly serve a useful purpose.

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Reinforced Concrete.

REINFORCED CONCRETE.—A Manual of Practice. By Ernest McCullough, M. W. S. E. Chicago: Cement Era Publishing Co. 5 × 8 ins.; pp. 128. Frontispiece and illustrations in text. $1.

Up to within the recent past the literature of concrete, outside of the technical press, has consisted of discussions of theory and rather formal description of past work, a natural tendency resulting from the novelty of construction. During the past year, however, the details of practice have absorbed the attention of those concrete engineers whose tastes and talents have a literary turn, and it is in this class that Mr. McCullough's little book should be placed. It is frankly a "manual of practice," and as such it is as complete as its limited size admits. It is only when it leaves practice to take up theory that its usefulness diminishes.

The author, apparently, has had considerable experience in concrete design and construction and it is his intention to place the fruits of that experience before the practical man who wishes to take up concrete work, mainly, it would seem, from the contractor's standpoint. The pages are full of useful hints as to methods, the kinds of tools to use, the personnel of the force, the conduct of the work, form design and construction, all quite clearly and correctly stated. In this portion the new concrete man should find much to help him in his studies.

In the theoretical portion, the author falls into the difficulties generally experienced when a more or less complicated theory is put into simple words. The trouble seems to be that the attempt at simplification is carried too far. The theory of the reinforced-concrete beam is not abstruse, even if some of the earlier discussions of the subject made it so, but it does require, for the understanding, a knowledge of the elements of the strength of materials and mechanics. Any simplification of the theory for the man not having this knowledge must generally fail because the author, having an understanding of the theory, can hardly put himself in the place of his reader, to the extent of defining explicitly the terms used. The result is a theory complicated to the uninitiated and absurd to the experienced. It is no easy task to write down to one's readers, and had the author of this book accomplished it, he would have completed an admirable concrete hand-book, for the arrangement of his material is good, the tables for design are well presented and his practical advice extremely useful. The low price is an additional recommendation.

In the theory there are two errors that should be corrected; the first, on p. 13, is a confused, if not entirely inaccurate, definition of the modulus of elasticity; and on p. 61, in the design of chimneys, there is the common error of considering the middle-third theory of masonry stresses applicable to circular sections, when it is, in fact, only true for rectangular sections. Again, on p. 107, the degree of solution in the hydrochloric acid bond is not clearly stated.

Although there is no disputing taste, we would suggest to the publishers the questionable judgment of displaying, as a frontispiece, the portrait of an author while he is yet alive.

◆

THE STRENGTH OF CONCRETE BEAMS.—Results of Tests of 108 Beams (First Series) Made at the Structural-Materials Testing Laboratories. By Richard L. Humphrey. Department of the Interior, U. S. Geological Survey, Bulletin 344. Washington, D. C.: Govt. Printing Office. Paper; 6 × 9 ins.; pp. 54; plates and illustrations.

This is the first of the reports of the St. Louis laboratory on beam tests, the beginning of the extended series of experiments on reinforced concrete which it is intended to carry out in the future. The present tests are on plain concrete beams, of variable length, kind of aggregate, time of test and method of mixing. No deductions are made on the results, but the data are quite fully recorded for the benefit of the individual engineer who wishes to make his own generalization from the results. As these tests promise to be the most complete ever made on any structural material, the successive reports as they appear are valuable as parts of the entire series. The uniformity of the program gives to each portion a value not ordinarily found in the segregated test.

◆

PRACTICAL REINFORCED CONCRETE STANDARDS. —For the Design of Reinforced Concrete Buildings. By H. B. Andrews, M. Am. Soc. C. E. Boston, Mass.: Simpson Bros. Corporation. Cloth; 8 × 11½ ins.; pp. 46; text illustrations and tables. $2.

The growth of reinforced concrete as an architectural material has made it necessary for many architects, who had their training when concrete was only a mason's material, to renew their student days. In order to help these men and to aid them in their design the book noted above has been prepared. It contains chapters on the design of beams, with tables and diagrams, and standardized sizes for buildings, together with sets of specifications for concrete work. Allowing for the usual tendency to use a designing diagram without regard for the varying conditions that must affect the design, this book of standards must be of value.

◆

THE BUILDING MECHANICS' READY REFERENCE.—Cement Workers' and Plasterers' Edition. By H. G. Richey, Superintendent of Construction U. S. Public Buildings. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Leather; 4 × 7 ins.; pp. 458; 193 illustrations in the text, and numerous tables. $1.50, net; English price, 6s. 6d., net.

In the cement-workers' and plasterers' edition Mr. Richey has brough out the fourth of his series of builders' hand-books, the first three being for (1) carpenters and woodworkers, for (2) stone and brick masons, and for (3) plumbers, steamfitters and tinners. The books are all published in uniform binding and typography, but aside from certain standard tables of sizes, mensuration, etc., each edition is entirely devoted to its own particular subject.

The cement-workers' edition, which has just been published, is an admirable book to put in the hands of the mason or mechanic who wishes to learn something about the rapidly-growing cement industry. It is not technical, nor does it pretend to be, so that all of the higher mathematical discussions and standards of design are omitted; but the bases of good construction, for which the workman himself is responsible, are clearly explained.

◆

THE PLANE TABLE.—And Its Use in Surveying. By W. H. Lovell, Topographer U. S. Geological Survey. New York: McGraw Publishing Co. Cloth; 4¾ × 7½ ins.; pp. 49; eight text illustrations and one plate. $1, net.

While not containing any additional information than the usual chapter on the plane-table in any of the standard works on surveying, the compact form of this little book by Mr. Lovell may make it useful for those learning map plotting by use of the plane-table. The instructions regarding the practical use of the instrument and its equipment are much better than the treatment of the three-point problem, which is rather too confused to convey a clear understanding to the student approaching for the first time this most important factor of plane-table surveying.

◆

VOIDS, SETTLEMENT AND WEIGHT OF CRUSHED STONE.—By Ira O. Baker. Bulletin No. 23, University of Illinois Engineering Experiment Station. Urbana, Ill.: The University. Paper; 6 × 9 ins.; pp. 29; 18 tables.

The lack of any authentic data upon the characteristics of crushed stone and the great variation in the assumed standards of its weight, settlement and percentage of voids, led Prof. Baker to institute the tests which are reported in the above-noted bulletin. The experiments do not cover a very large field, either in amount of tests or the kinds of stone investigated, but the results are fairly uniform and the deductions therefrom should prove of value to the engineer estimating upon structures using crushed stone or paying for the delivery of such stone either in cars or carts.

◆

THE VITALITY OF THE TYPHOID BACILLUS IN ARTIFICIALLY INFECTED SAMPLES OF RAW THAMES, LEE AND NEW RIVER WATER, WITH SPECIAL REFERENCE TO THE QUESTION OF STORAGE.—First Report on Research Work by Dr. A. C. Houston, Director of Water Examinations, Metropolitan Water Board. (London, England: The Board.) Paper; 8 × 13 ins.; pp. 32.

Eighteen samples of unsterilized water, divided equally between the three rivers named, were in-

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oculated with typhoid germs and subsequently studied from time to time, all in the laboratory. The results, from the viewpoint of the operating water-works official, emphasized anew the great value of even a few days storage of water *before filtration* and indicated that

> Although as a counsel of perfection a water should possibly be stored for one to two months, storage for four weeks may perhaps, in the present state of our knowledge, be regarded as affording a sufficient margin of safety.

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◆

British Practice With Electric Power.

ELECTRIC POWER AND TRACTION.—By F. H. Davies, Assoc. M. Inst. E. E. New York: D. Van Nostrand Co. Cloth; 5½ × 8½ ins.; pp. 293; 67 illustrations in the text. $2, net.

Although this book bears the mark of an American publisher, it is soon discovered that it is devoted to English methods and machinery when the minor, but notable, departures from well-known American practice are noted. For the author's standpoint alone, the book should be welcome in this country. Mr. Davies has assumed that the reader is familiar enough with the fundamental electrical phenomena and principles underlying the design and operation of electric power apparatus to understand descriptions of technical details at once.

The first three chapters are quite general, taking up broadly the history of electric-power developments from the early days and the arrangement of the present direct and alternating-current works. When the author says "present-day plants" he seems to mean for the most part 220-volt, three-wire, direct-current and small 2,000-volt, single-phase systems. The high-tension, long-distance works he regards as the future rational and economic development of electricity supply. There is one statement in this part of the book that will entertain American readers particularly.

> In America there are several instances of 30,000-volt overhead transmission lines and a few are working at 40,000 volts and even higher pressures.

Next the author takes up the subject of motors and classifies them into three groups; direct-current, single-phase and polyphase alternating-current. The direct-current motors are further grouped into the familiar shunt, series and compound types. In setting forth the suitability of these three types for various services the peculiar characteristics of each are briefly told. It should be remarked here, however, that much confusion is apt to arise in the minds of American readers by Mr. Davies' use of the term "compound-wound." He uses it to designate a motor having a series-field winding opposed in its magnetizing action to the shunt field. Such a motor in America is called a "differential" and its use is very limited. What we here call a "compound" Mr. Davies does not mention at all. The type, however, does have extensive use in elevators, hoists, etc. Alternating-current motors are summarily disposed of by explaining in simplest possible terms the action of rotating fields, etc.

The advantages of using electric motors in industrial works generally are considered in one chapter, in which, also, comparisons are drawn between motor and complex belt driver. The remainder of the book is filled wiht matter on the special applications of electric power—in collieries, machine shops, textile mills, printing houses, on shipboard, for canal and railroad haulage. The matter relative to electric railroading alone fills about half the volume.

The first part of the work on electric traction is a historical resumé of advances made. The author can scarcely hope to secure much sympathy, on this side of the Atlantic, when he writes:

> Contrary to the popular idea which attributes all electrical invention and progress to America, a Scotchman, Robert Davidson by name, must be credited with having taken the first practical steps in electric traction. Somewhere about 1837 he designed and built an electrical locomotive. . . .

The author credits the next important advance to C. G. Page, of the Smithsonian Institution. Nothing is said whatever of the American, Davenport, who is credited with earlier work.

Track work and the distribution of current by overhead, conduit and surface contact systems form the next three chapters, after which subjects like car building and equipment, signalling, substations, car control, etc.

In the last chapter the limitations of direct-current traction are discussed and compared with the advantages of the single and three-phase systems. A few notable installations of these systems, in America and Europe, are very briefly described.

◆

The Financing of Power Developments.

NOTES ON HYDRO-ELECTRIC DEVELOPMENTS.—By Preston Player. New York: McGraw Publishing Co. Cloth; 4¾ × 7½ ins.; pp. 68; three illustrations in the text. $1, net.

Mr. Player has here given a general treatise on the commercial side of the development of hydro-electric power. The results of engineering studies figure prominently, but the real engineering work on any proposed development has no part in this little book. The volume has been written ostensibly for the guidance of a business man interested in such power developments, and it is the author's expressed intention to show how the promoter would set about to determine what part of the maximum or minimum power available should be developed, what receipts might be expected and in what ways local competition should be met. It is expected, of course, that the promoter is able to get the best of engineering advice on the basis of his studies.

The author starts with the local promoters who may have carried the project as far as their limited opportunities permitted and who may have finally brought the whole matter to the attention of some financier of broader interests. The first thing to be ascertained by him is whether or not they have anything to offer; if they control the situation.

If the preliminary scrutiny of the plans is favorable then, the author advises an option is to be secured, pending a careful and complete study by electrical and hydraulic engineers. What points the document should cover are tabulated in the book. The method of studying the local market for energy and the cost of local supply are given, as leading up to determining whether the best investment would be in pur-

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HELLER—Stresses in Structures and the Accompanying Deformations.
By A. H. Heller, C. E., Late Professor of Structural Engineering, Ohio State University. Second edition. 8vo, xvi + 324 pages, 217 figures. Cloth, $3.00.

CLOKE—The Gunner's Examiner.
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chasing competing companies, in competing with them, or in selling current to them at attractive prices.

Under the chapter heading Primary and Secondary Powers, the author discusses the conditions under which it is feasible to develop for more than the minimum flow of the river in question, as determined from its history. Here the writer outlines the proposition that it may be a better financial move to set aside a certain percentage of receipts as insurance against suits through broken contracts once in some 20 years than to invest certain capital in sufficient idle machinery to be able to furnish the required power under unusually trying conditions.

The side of power development treated in this volume is one with which only comparatively few engineers, and these the older and more experienced ones, are familiar. Therefore this book should be particularly interesting to younger men in electrical and hydraulic work.

◆

COMMISSIONER OF HEALTH OF THE COMMONWEALTH OF PENNSYLVANIA.—First Annual Report [June 6, 1905, to Dec. 31, 1908.] Samuel G. Dixon, M. D., Commissioner. Harrisburg, Pa.: Pub. Doc. Cloth; 6 × 9½ ins.; pp. 519; plates and tables.

A review of the work of the reorganized health department of Pennsylvania during the first year and a half of its existence is here given. The department now has divisions of sanitary engineering, medical inspection, vital statistics, morbidity statistics, etc. The report of Mr. F. Herbert Snow, Chief Engineer, details the organization and work of his division, including reports on water supply and sewage disposal. Special reports deal at length with the typhoid epidemic at Nanticoke and with a survey for mosquito control. It is a great pity that such interesting and important matter should be so long delayed in its appearance.

◆

Publications Received.

THE AIR AND VENTILATION OF SUBWAYS.—By George A. Soper, Ph. D., M. Am. Soc. C. E. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¼ × 8¼ ins.; pp. 229; 44 illustrations in the text. $2.50; English price, 10s. 6d., net.

BULLETINS, U. S. GEOLOGICAL SURVEY.—George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.

No. 345: Mineral Resources of Alaska. Report on Progress of Investigations in 1907. By Alfred H. Brooks and others. Pp. 294; five plates (one in pocket) and seven text illustrations.

COMMISSIONERS OF THE STATE RESERVATION AT NIAGARA.—24th Annual Report, from Oct. 1, 1906, to Sept. 30, 1907. (Charles M. Dow, President). Albany, N. Y.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 54; plates.

CONNECTICUT SOCIETY OF CIVIL ENGINEERS.—Papers and Transactions for 1907, and Proceedings of the 24th Annual Meeting at New Haven, Feb. 11-12, 1908. (J. Frederick Jackson, Secretary, New Haven, Conn.) Paper; 6 × 9¼ ins.; pp. 157; illustrated.

CURVES FOR CALCULATING BEAMS, CHANNELS AND REACTIONS.—A Manual for Engineers, Architects, Designers, Draftsmen, Builders and Contractors. By Sidney Diamant, E. E., Structural Engineer. New York: McGraw Publishing Co. Cloth; 10 × 7¼ ins.; pp. 13; 25 plates and 6 text illustrations. $2, net.

DROWNED STATE LANDS ON THE SARANAC RIVER.—New York: The Association for the Protection of the Adirondacks (Edward Hagaman Hall, Secy., Tribune Building). Paper; 5¾ × 9 ins.; pp. 22; plates.

DYNAMO-ELECTRIC MACHINERY.—An Authoritative Treatise on the Theory, Constructive Details, Calculation, Characteristic Curves, and Design of Dynamo-Electric Machinery. By Francis B. Crocker, E. M., Ph. D., Head of Department of Electrical Engineering Columbia University, Past-President Am. Inst. E. E., Chicago, Ill.: American School of Correspondence. Cloth; 6½ × 9¾ ins.; pp. 235; plates, and 260 text illustrations. $1.50.

FLOODS AND FLOOD PROTECTION.—References to Books and Magazine Articles. (Reprinted from the Monthly Bulletin, July, 1908.) Pittsburg, Pa.: Carnegie Library. Paper; 6 × 9 ins.; pp. 48.

GOLD AND SILVER.—Comprising an Economic History of Mining in the United States, the Geographical and Geological Occurrence of the Precious Metals, with Their Mineralogical Associations, History and Description of Methods of Mining and Extraction of Values, and a Detailed Discussion of the Production of Gold and Silver in the World and the United States. By Walter R. Crane, Ph. D., Instructor in Mining, School of Mines, Columbia University. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 727; 29 illustrations, partly in the text. $5, net; English price, 21s., net.

HIGH SPEED DYNAMO ELECTRIC MACHINERY.—By H. M. Hobart, M. Inst., C. E., M. Am. Inst. E. E., M. Inst. E. E., and A. G. Ellis, Assoc. M. Inst E. E., Associate City and Guilds of London Institute. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 6 × 9¼ ins.; pp. 526; 355 illustrations, mostly in the text. $6; English price, 25s. 6d., net.

HOUSE PAINTING, Glazing, Paper Hanging and White-Washing.—A Book for the Householder. By Alvah Horton Sabin, M. S., Author of "Technology of Paint and Varnish." New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5 × 7½ ins.; pp. 121. $1.00; English price, 4s. 6d.

INDIANA ENGINEERING SOCIETY.—Proceedings of the 28th Annual Meeting, Held at Indianapolis, Ind., Jan. 16-18, 1908. Indianapolis, Ind.: The Society (Charles Brossman, Secy.) Paper; 6 × 9 ins.; pp. 224; folding and other plates, and text illustrations. 50 cts.

LOGARITHMS AND TRIGONOMETRY for Engineers and Surveyors.—By Ernest R. Matthews, Assoc. M. Inst. C. E., and T. G. Howes Thomas, Assoc. M. Inst. C. E. London, England: The St. Bride's Press, Ltd. Cloth; 5½ × 9 ins.; pp. 51; 15 figures and 4 tables in the text. English price, 2s., net.

NATIONAL FIRE PROTECTION ASSOCIATION.—Proceedings of 12th Annual Meeting, Held in Chicago, May 26-28, 1908. (W. H. Merrill, Secy., 382 Ohio St., Chicago, Ill.) Stiff paper; 5½ × 9 ins.; pp. 221.

PRACTICAL METALLURGY.—An Introductory Course for General Students. By Thomas Turner, Professor of Metallurgy in the University of Birmingham. London, England: Charles Griffin & Co., Ltd. Philadelphia, Pa.: J. B. Lippincott Co. Cloth; 5 × 8 ins.; pp. 103; five illustrations in the text. $1.25, net.

PREPARING LAND FOR IRRIGATION.—Elwood Mead, Chairman, State Rivers and Water Supply Commission, Melbourne, Victoria. (From "The Journal of the Department of Agriculture of Victoria," February, 1908.) Paper; 6 × 9¾ ins.; pp. 14; illustrated.

PROGRESS IN CHESTNUT POLE PRESERVATION.—By Howard F. Weiss, Chief, Section of Research, Office of Wood Preservation. Circular 147, Forest Service, U. S. Department of Agriculture, Gifford Pinchot, Forester. Washington, D. C.: Pub. Doc. Paper; 6 × 9 ins.; pp. 14; two text illustrations and nine tables. 5 cts.

THE PURIFICATION OF WATER BY SAND FILTRATION.—With Special Reference to Recent Improvements Greatly Reducing Both Construction and Maintenance Costs. By William B. Fuller, Consulting Civil Engineer, New York City. (Reprinted from Connecticut Society of Civil Engineers Report, 1908.) Paper; 6 × 9¼ ins.; pp. 18; text illustrations.

RAILROAD COMMISSION OF WISCONSIN.—(J. M. Winterbotham, Secy.) Madison, Wis.: Pub. Doc. Cloth; 6 × 9 ins.

First Annual Report, from Dec. 1, 1906, to June 30, 1907. (Statistics from June 30, 1906, to June 30, 1907.) Pp. 754; one folding plate.

Opinions and Decisions of the Commission. Vol. I., July 20, 1905, to July 31, 1907. Compiled by J. M. Winterbotham, Secretary. Pp. 855.

RAILROAD SIGNAL DICTIONARY.—An Illustrated Vocabulary of Terms which Designate American Railroad Signals, Their Parts, Attachments and Details of Construction, with Descriptions of Operations and Some Illustrations of British Signals and Practice. Compiled for The Railway Signal Association by Braman B. Adams and Rodney Hitt, Associate Editors of the "Railroad Gazette." New York: "Railroad Age Gazette." London, England: "The Railway Gazette." Leather; 8½ × 12 ins.; pp. of text 32; 3,120 illustrations. $6.00.

RAILWAYS IN INDIA.—Administration Report for the Calendar Year 1907, by the Railway Board. Simla, India: Pub. Doc. Stiff paper; 8½ × 13¼ ins.; pp. 310; folding map and diagram in pocket. 2s. 8d.; American price, $1.

A REPORT ON THE WATER SUPPLY OF CAIRO.—By Professor Gärtner, Dr. Dienert and Dr. Houston. (Supplement to the "Journal Officiel" No. 149, Dec. 30, 1907.) Cairo, Sgypt: Pub. Doc. Paper; 9¾ × 12½ ins.; pp. 21.

A REVIEW OF THE CHICAGO SANITARY AND SHIP CANAL.—With Suggestions for a Harbor. An address before the Chicago Real Estate Board, by John W. Alvord, Hydraulic and Sanitary Engineer, Chicago, March 20, 1908. Paper; 6 × 9¼ ins.; pp. 27.

RULES AND REGULATIONS FOR THE PREPARATION AND SUBMISSION OF PLANS FOR SYSTEMS OF SEWERAGE AND SEWAGE DISPOSAL.—Together with Extracts from Public Health Law and the Village Law Relating to "Potable Water" and "Sewers." Albany, N. Y.: State Department of Health, Division of Sanitary Engineering (Theodore Horton, Chief Engineer). Paper; 4 × 6½ ins.; pp. 16; one text illustration.

SOME APPLICATIONS OF THE "CLARIFICATION TEST" TO SEWAGE AND EFFLUENTS.—By Gilbert John Fowler, D. Sc., F. I. C., Sam Evans, B. Sc. (Tech.), and Arthur Chadwick Oddie. (Reprinted from the Journal of the Society of Chemical Industry, March 16, 1908, No. 5, Vol. XXVII.) Paper; 7¾ × 10¾ ins.; pp. 11; 12 tables. (Address Dr. Fowler at Urmston, near Manchester, England.)

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8-11*	Sidewalks, Saranac Lake, N. Y. ....(S.)	8- 6
8-15	Boilers, Philadelphia, Pa.....(S.)	7-30
8-17	Bridge, Lakewood, Ohio (P. & S.)	8-13
8-17*	Paving, Asbury Park, N. J. (S.)..	8-13
8-17*	Storm drains, Canajoharie, N. Y. (S.)	8-13
8-19*	Pumping plant, equipment, Jerseyville, Ill. ....(P. & S.)	7-23
8-20*	Garbage removal, Youngstown, O. ....(P. & S.)	8- 6
8-20*	Viaduct, Atlanta, Ga. (P. & S.)...	8-13
8-21*	Arch bridge, Woonsocket, R. I. (P. & S.)..................	8-13
8-24*	Cement, Detroit, Mich. (S.).......	7-30
8-25*	Conduit, Toledo, Ohio (P. & S.)..	8-13
8-26*	Riprap seawall, Boston, Mass (P. & S.)...................	7-30
8-26*	Revetment, etc., Milwaukee, Wis. ....(S.)	7-30
8-27	Dam, etc., Orland, Cal.......(S.)	6-11
9- 4*	Channel, Boston, Mass (P. & S.)	8- 6
9- 5	Elevator, Bremerton Wash....(S.)	8-13

LIST OF CONTRACTS PENDING.

LIGHT, HEAT AND POWER PLANTS.

8-15	Conduit, Takoma, D. C...........	8- 6
8-17	power house, Alamogordo, N. M.	8- 6
8-18	Conduit, etc., Green Bay, Wis....	8- 6
8-24	Light plant, New Bremen, Ohio..	8- 6
8-25*	Power-house equipment, etc., Port Washington, Wis............	7-30
8-26*	Power-houses, Wheeling, W. Va..	7-30
8-31	Power-house, Wheeling, W. Va..	8- 6
9- 8	Lighting, Kenosha, Wis	8-13
9-14	Lighting streets, Hartford, Conn.	7-30
9-15	Elec. light plant, Winnipeg, Man.	7-30
9-19	Light plant, Tacoma, Wash.......	8-13

BRIDGES.

8-14	Bridge, Mt. Gilead, Ohio..........	8-13
8-17	Bridges, Linton, N. Dak..........	8- 6
8-17	Bridge, Lakewood, Ohio	8- 6
8-17	Bridge, Springfield, Ohio	8- 6
8-18	Bridge, etc., Plattsmouth, Neb...	8- 6
8-18*	Bridge, Salisbury, Md.	7-30
8-18	Bridges, Williamsport, Pa........	8-13
8-18	Bridge, Mahomet, Ill.	8-13
8-19	Bridge work, etc., Cleveland, O..	7-30
8-20*	Viaduct, Atlanta, Ga..............	8- 6
8-20	Bridges, Blue, Okla	
8-20	Bridge, Milwaukee, Wis...........	8-13
8-21*	Bridge, Woonsocket, R. I..........	8- 6
8-22*	Bridge, Rocky River, Ohio......	7-23
8-24	Bridge, Warren, Ohio.............	8- 6
8-24	Bridge, Colville, Wash............	8- 6
8-25*	Bridge, Springfield, Ohio.........	8-13
8-26	Bridge, Norristown, Pa...........	8- 6
8-28	Substructure, Irondale, Ohio.....	8-13
8-28	Bridge work, Columbus, Ohio....	8-13
8-29	Culverts, Indianapolis, Ind........	8-13
8-31	Substructure, etc., St. Clairsville, Ohio	8-13
8-31*	Bridge, Cuba (U. S. Possess.)....	7-30
9- 1*	Bridge, Missoula, Mont............	8-13
9- 2*	Bridge equip., Chicago, Ill.	7-30
9-16*	Bridge, Morenci, Ariz..............	8-13

BUILDINGS.

8-13	Heating, New York, N. Y..........	8- 6
8-15	Bank, Pittsburg, Pa................	8-13
8-15	Buildings, Washington, D. C....	8-13
8-15	Hospital, Boise, Idaho.............	7-30
8-15	Building, New York, N. Y........	7-23
8-17	Building, Grand Rapids, Minn....	7-30
8-17	Engine houses, New York,.........	8- 6
8-18	Furniture, Coshocton, Ohio........	8-13
8-19	Schools, New York, N. Y..........	8-13
8-19	Court-house, Indianapolis, Ind...	8- 6
8-19	Armory, Ionia, Mich...............	7-30
8-19	Armory, Pontiac, Mich.............	7-30
8-19*	Post-office, Petersburg, Va	7-16
8-20	Hospital, Pittsburg, Pa............	7-23
8-20	Storehouse, New York, N. Y....	8- 6
8-20	Pub. library, New York, N. Y....	8- 6
8-24*	Post-office, Logan, Utah..........	7-16
8-24	Hospital, Chicago, Ill..............	8-13
8-24*	Buildings, West Point, N. Y......	8-13
8-24	Nurses' home, New York, N. Y..	8-13
8-25	School, Central Falls, R. I.........	8-13
8-26	School, Chicago, Ill................	8-13
8-27	Jail, etc., Hillsboro, Ill............	8-13
8-27*	Hospital repairs, Ft. Hancock, N. J................................	7-30
8-31	Post-office, extension, Little Rock, Ark.	7-23
9- 1	School plans, St. Paul, Minn....	7- 9
9- 1	Post-office, Greenville, Ohio....	7-23
9- 1	Laundry, Columbus, Ohio (Mfg. Pl.)	8-13
9- 3*	Buildings, Ft. Monroe, Va.........	8-13
9- 5	Elevator, Bremerton, Wash	8-13
9- 5	Prison, Portsmouth, N. H.........	8-13
9- 8*	Vacuum system, Wash., D. C...	8-13
9- 9*	Post-office, Sheridan, Wyo........	8-13
9-14	Post-office, St. Louis, Mo.........	8- 6
9-10	Post-office, Kenosha, Wis.........	8-13
9-16	Post-office, Youngstown, Ohio....	8-13
9-17*	Vault, Washington, D. C..........	8-13
9-17*	Post-office, Escanaba, Mich.......	8-13
9-22	Laboratory, etc., Ann Arbor, Mich.	7-23
9-23	Court-house, Green Bay, Wis..	6-18
9-30	Post-office, Cape Girardeau, Mo.	8- 6

WATER-WORKS.

8-14*	Reservoir, Lincoln, Neb.	7-30
8-14*	Water-works, De Funiak Springs, Fla.	7-30
8-15*	Chimney, Dallas, Tex.............	7-30
8-15	Boilers, Philadelphia, Pa.........	7-30
8-15	Well, Los Angeles, Cal...........	8- 6
8-17	Water system, Chehalis, Wash....	8- 6
8-17	Basin, Tulsa, Okla................	8- 6
8-17*	Pipe, Yonkers, N. Y.	7-30
8-18	Conduit system, Green Bay, Wis..	7-23
8-18*	Water-works, Brandon, Vt........	8- 6
8-19*	Pumping plant, equipment, Jerseyville, Ill.	7-23
8-19	Water mains, New York, N. Y....	8-13
8-20	Water-works, Hospers, Iowa	8- 6
8-24*	Water-works, Rockville, Ind......	8- 6
8-25	Filters, etc., Peekskill, N. Y.....	8- 6
8-25*	Conduit, Toledo, Ohio	8- 6
8-25	Water mains, Toronto, Ont.......	8-13
8-26	Cast-iron pipe, New York, N. Y.	8-13
8-27	Dam, Orland, Cal................	6-11
8-29	Water tank, Ft. Barrancas, Fla..	8- 6
8-31*	Canal, Portland, Ore..............	8-13
8-31*	Water mains, Wallingford, N. J..	8-13
9- 1	Water-works, Russelville, Ala....	8-13
9- 1*	Concrete conduit, New York, N.Y.	7-30
9- 1*	Filtration plant, Winnetka, Ill....	8- 6
9- 2*	Water tower, Platte, S. Dak......	8-13
9- 3	Water system, Fort Sam Houston, Tex.	8-13
9- 9*	Pipe line, Springfield, Mass	8-13
9-16*	Pipe, Morenci, Ariz...............	8-13
9-24*	Filtration plant, Evansville, Ind..	8- 6
10-14	Cast-iron pipe, etc., Vancouver, B. C..............................	8-13

SEWERS.

8-13	Sewer, Gates, N. Y...............	8-13
8-14	Sewers, Buffalo, N. Y.............	8- 6
8-14	Sewers, Salt Lake City, Utah.....	8- 6
8-14	Sewers, Youngstown, Ohio........	8- 6
8-14*	Sewer, Louisville, Ky.............	7-30
8-17*	Sewer pipe, Brantford, Ont.......	8- 6
8-17	Sewers, Washington, D. C........	8- 6
8-17	Sewers, East Liverpool, Ohio......	8- 6
8-17*	Sewers, Canajoharie, N. Y.......	8- 6
8-17	Sewer, Pittsburg, Pa.............	8-13
8-17	Sewer, Yonkers, N. Y.............	8-13
8-18	Pipe sewers, Sioux City, Iowa....	8-13
8-18	Sewer, Hamilton, Ohio............	8-13
8-18	Sewers, Middletown, Ohio........	8-13
8-18*	Sewers, Dalhart, Tex	8- 6
8-20*	Sewers, Forest City, Pa.	7-30
8-20	Sewer, Bozeman, Mont............	8-13
8-20	Sewer, Salem, Ohio..............	8-13
8-21*	Sewer, Louisville, Ky............	7-30
8-24	Sewer, Fargo, N. Dak............	8-13
8-27*	Septic tank, Seneca Falls, N. Y..	8-13
8-27	Drains, Fort Leavenworth, Kan..	8-13
8-31	Sewer, Frazeyville, Ohio.........	8-13
8-31*	Sewer, New Brunswick, N. J....	8-13
9- 1	Sewer, Jackson, Ohio	7-23
9- 7*	Sewers, Vicksburg, Miss.........	7-30
9-14*	Engines, Wash., D. C...........	8-13

STREETS AND ROADS.

8-14*	Roads, Phillipsburg, N. J......	7-23
8-14	Grading, Memphis, Tenn.........	7-30
8-14	Grading, etc., Oakley, Ohio.......	8-13
8-15	Street impvt, Hot Springs, Ark..	8- 6
8-15	Road, Jacksboro, Tenn...........	8- 6
8-17	Road, Fowler, Ind................	8- 6
8-17*	Paving, Asbury Park, N. J.......	8- 6
8-17	Curbing, etc., Yonkers, N. Y.....	8-13
8-17	Sidewalks, etc., San Diego, Cal....	8-13
8-17	Pavement, Mexico, Mo............	8-13
8-17	Paving, Zanesville, Ohio..........	8-13
8-17	Paving, Oakmont, Pa..............	8-13
8-17	Macadam, etc., White Plains, N. Y............................	8-13
8-17	Asphalt, etc., Hartford, Conn.....	8-13
8-18*	Pavement, Bayonne, N. J..........	8-13
8-18*	Sidewalk, Greenville, N. C.........	8-13
8-18*	Pavt., etc., Saranac Lake, N. Y..	8- 6
8-19	Regulating, etc., Brooklyn, N. Y..	8- 6
8-20	Paving, San Antonio, Tex.........	8-13
8-22	Road, Terre Haute, Ind............	8- 6
8-23	Road, Brookville, Ind.............	7-23
8-24	Roads, Fort Barrancas, Fla.......	8-13
8-25*	Pavement, Norfolk, Neb..........	8- 6
8-25	Paving, etc., New York, N. Y....	8-13
8-26	Road impvt, Cleveland, Ohio......	8-13
8-27*	Pavement, Westfield, N. J........	8- 6
8-28	Road impvt, Cincinnati, Ohio......	8-13
8-29	Road, Williamsport, Ind...........	8-13
8-31	Paving, Fort Edward, N. Y......	8-13
8-31*	Street impvt., Mineola, N. Y.....	8- 6
9- 2*	Macadam, Jamesburg, N. J........	8-13
9- 5	Road, Terre Haute, Ind...........	8-13
9- 7	Road, Danville, Ind...............	8-13
9- 7	Road, Liberty, Ind................	8-13
9- 8	Road, Vincennes, Ind.............	8-13
9- 9	Roads, Muncie, Ind...............	8-13

MISCELLANEOUS.

8-14	Dredging, Oakland, Cal.	8- 6
8-14	Light-house, Alaska	5-21
8-15	Ditch, Rochester, Ind...............	8-13
8-17	Ditches, drains, Hartford, Conn..	8-13
8-17	Sale of vessel, Wash., D. C.......	8-13
8-17	Wall, Tama, Iowa	8-13
8-17	Shop machines, drills, etc., Panama.	8- 6
8-18*	Dredging, Trenton, N. J...........	7-30
8-18*	Coal handling machinery, Philadelphia, Pa	7-30
8-18	Concrete dam, Front Royal, Va..	8-13
8-18	Wharf repairs, San Francisco, Cal.	8-13
8-18	Wharf, Ft. Adams, R. I...........	8-13
8-19	Ditches, Webster, Iowa	8-13
8-19	Dyking, Aberdeen, Wash...........	8-13
8-19	Drainage, Emmetsburg, Iowa.....	8-13
8-20	Tile drain, Eldora, Iowa...........	8-13
8-20	Trans-Continental Ry., Ottawa, Ont. (Railways)	7-30
8-21	Garbage disposal, etc. (Garbage), Vincennes, Ind..................	8-13
8-21	Drain, Paris, Ill...................	8-13
8-22*	Stone, New York	8- 6
8-24	Cars, gages, cross-ties, Panama..	8- 6
8-24*	Cement, Detroit, Mich	7-30
8-24*	Earth excavation, Detroit, Mich..	7-30
8-24	Levee, New Orleans, La...........	8-13
8-25*	Crematory, Fort Andrews, Mass..	7-30
8-25*	Seawall, Ft. Mason, Cal.	8- 6
8-26*	Metal work, Hawaii	7-30
8-26*	Revetment, etc., Milwaukee, Wis.	7-30
8-26*	Riprap seawall, Boston, Mass....	7-30
8-26	Fire-boat, fire pumps, Boston, Mass	8-13
8-27	Wharf, etc., Port Townsend, Wash	8-13
8-29*	Garbage removal, Youngstown, O.	7-30
8-31*	Dredge, Petersburg, Va.	7-30
8-31*	Cable railways, Panama	8- 6
8-31	Trolley material, Boston, Mass...	8-13
8-31	Riprap, Wilmington, N. C.........	8-13
8-31*	Canal, Portland, Ore..............	8-13
9- 1	Steel rails, Trans-Continental Ry.	8-13
9- 1	Monument designs, Mexico	5-21
9- 4*	Dredging, Plymouth, Mass........	8- 6
9- 5*	Lumber, etc., Charleston, S. C...	8- 6
9- 5*	Dredging, Philadelphia, Pa.......	8-13
9- 7*	Embankment, Greenville, Miss....	8-13
9- 9	Sale of railway, Atlantic & Lake Superior Ry.	7-23
9- 9	Sale of Ry., Baie des Chaleurs Ry.	8- 6
9-12	Sale of electric railway property, Mt. Vernon, Ohio	8- 6
11- 2	Submarines, Wash., D. C..........	8-13

FOREIGN.

8-19	Railway, Belgium	8- 6
8-20	Dock construction, Belgium......	7-16
8-27	Water-works, Egypt	8- 6
10- 1	Railway material, Siam	7-16
10-14	Dredging, Spain	7-16
10-29	Reservoir, pipe, India	8- 6
11- 2	Electric plant, Chile	7-16
11- 4	Reservoir, India	8- 6
12- 1*	Sewers, paving, Ecuador	8- 6

RAILWAYS.

ALEXANDRIA, LEESVILLE, LUFKIN & WESTERN.—Mike O'Brian, Pres., Leesville, La., advises us that contracts will be let for building this road as soon as capital is arranged for. As noted on June 25, this company plans to build and operate a standard-gage line from Alexandria, La., through the Parishes of Rapides and Vernon by way of Leesville to the Sabine River, thence across this river and through the counties of Newton, Jasper, Angelina in the state of Texas to Lufkin, Tex., 179 miles. Right-of-way is obtained. Survey is partly made. Capital stock, $1,000,000.

BAKERSFIELD & VENTURA.—This company was incorporated on July 31 in California by Charles T. Carnahan, John A. Ewing, Martin M. Hamma, Samuel M. Thompson, Jr., and H. Ferguson, all of Colorado. The principal office of the company is at Denver. The articles declare that it is the purpose of the company to purchase, maintain, operate, extend and complete the railway formerly owned and possessed by the Bakersfield & Ventura R. R. Co., which was sold by the Title Insurance & Trust Co., of Los Angeles, to T. W. Phelps as special administrator. The railroad property is described as a main line between Hueneme and Round Mountain, a main line between Los Angeles and Santa Cruz, a branch line between Sargent and Hollister, and other possessions. Authority to engage in the telephone, telegraph and express business is included. The capital stock is placed at $500,000. Meetings of the directors are to be held at Oxnard or Los Angeles. Taylor & Forgy, of Los Angeles, are attorneys for the incorporators.

BALTIMORE & OHIO.—Company is about to begin the work of abolishing about 50 miles of grade crossings in Baltimore, according to the New York "Tribune." Many miles of elevated tracks will be constructed, and the work will cost about $7,000,600. Isham Randolph, the Engineer appointed by Mayor Mahool, will be in charge of the work. The city and the railroad company could not agree upon a plan, and by mutual consent the Mayor called in Mr. Randolph to lay out a system, the city to pay for his services. Mr. Randolph solved the problem of eliminating grade crossings in Chicago.

CANADIAN NORTHERN.—The contract for the construction of the Viola Dale-Rapid City branch has been awarded to the NORTHERN CONSTRUCTION CO., Winnipeg, Man.

CAZENOVIA & SAUK CITY.—We are officially informed that this company, recently incorporated in Wisconsin, will let contracts about Sept. 1 for building its proposed line from Lavelle to Cazenovia and to Sauk City, 42 miles, connecting with the Chicago, Milwaukee & St. Paul Ry. at Sauk City. Capital, $30,000. Surveys are made and right-of-way partly obtained. J. E. Hanzlik is Secy., Cazenovia. Engineer has not been appointed yet. Previously noted.

DINWIDDIE & GARY.—Company has been organized to build the Chicago & Wabash Valley to Gary, Ind., a distance of 25 miles from its present northern terminus. The officers are: B. G. Gifford, Pres.; J. W. Belshaw, Vice-Pres.; F. E. Lewis, Secy.; Mrs. E. Schooley, Treas. Mr. Gifford is Pres. of the Chicago & Wabash Valley R. R., extending from Kersey to McCoysburg, Ind., 24 miles.

EMPIRE RY. CO.—Articles of incorporation of the Empire Railway, Mining & Milling Co. have been filed with the secretary of state, Colorado. The incorporators are Fred G. Bishop, Empire, Colo.; N. H. Brown, W. L. Shaffer, and E. M. Sabin, Idaho Springs, Colo. The company proposes to construct a railroad west from Empire, through the Daly mining district, over the Continental divide into Grand County, to connect with the Moffat road at or near Fraser; also a line through Montezuma and Breckenridge to Leadville, to connect with the Denver & Rio Grande and other lines and east from Empire through Idaho Springs to Denver.

GEORGIA SOUTHWESTERN & GULF.—We are officially advised that this proposed railroad will be 160 miles long, from Albany, Ga., southwest to St. Andrews Bay, Fla., on the Gulf of Mexico, via Colquitt and Donaldsonville, Ga., and Marianna, Fla. Right-of-way is secured. Survey has not yet been completed. Bids will be received in about 60 days. Capital has been obtained. W. M. Legg is Pres., 534 Washington Ave., Macon, Ga.; J. R. Mercer, Vice-Pres., Dawson, Ga.; H. J. Bruton, Secy. and Treas., and Russell & Hawes, General Counsel, at Bainbridge, Ga. T. H. Hazelrigg is Ch. Engr., 126 East Market St., Indianapolis, Ind. Noted on June 25.

INTEROCEANIC RY. (Mexico).—The engineering department of the National Lines of Mexico is preparing plans for changing this system to a standard-gage railway. It is 736 miles long. A. Clark, City of Mexico, is Gen. Mgr. Previously noted.

KENTUCKY SOUTHEASTERN.—Chartered in Kentucky to build a railroad line, ten miles long, in Bell County, Ky. The incorporators are T. J. Asher, Robert Asher, G. M. Asher, M. Brandenburg and R. W. Creech, of Wasioto, Ky., and William Low, of Pineville, Ky. See "Wasioto & Black Mt. Ry."

LAKE CHARLES RY. & NAVIGATION CO.—W. P. Weber, Pres., states that this company, which was recently incorporated in Louisiana, now has 20 miles of standard-gage railroad in operation from Hecker, La., but it is hoped to extend soon five miles into Kinder, La., and connect with the Colorado Southern Ry. The company also operates a barge line. Geo. M. King is Vice-Pres. and Treas. at Lake Charles, and D. A. Kelly is Gen. Mgr., at Edna, La.

LOUISIANA.—We are officially advised that the Southern Mineral & Land Improvement Co., of New Orleans, has let contract to M. TANSEY, Winnfield, La., for the construction of five miles of railroad from Winnfield, La., to its quarry. Surveys are made, right-of-way secured and capital obtained. I. L. Lyons is Pres.; R. M. Walmsley, Chas. C. Carroll, Warren Kearny, Gustaf R. Westfeldt and others, all of New Orleans, are the directors. J. F. Coleman, Hibernia Bank Bldg., New Orleans, is Ch. Engr.

NEWTON FALLS & NORTHERN.—This company has been incorporated to build a lumber railroad from Newton Falls to New Bridge, N. Y., six miles. Capital, $70,000. Incorporators: R. W. Higbie, W. W. Gillen and C. A. Ludlum, of Jamaica, N. Y.

SANFORD & EVERGLADES.—Organized in Sanford, Fla., to build from Sanford to the Everglades. Pres., A. T. Rossiter; Vice-Pres., L. O. Chase; Secy., J. N. Whitner; Treas., F. P. Foster. A. P. Connelly is Gen. Mgr.

TRANS-CONTINENTAL.—Bids are asked until noon, Sept. 1, by the Commissioners of the Trans-Continental Ry., Ottawa, Ont., for 44,447 gross tons of 80-lb. steel rails (open hearth or Bessemer, at the option of the Commissioners) and the necessary fastenings. P. E. Ryan, Secy.

VANCOUVER ISLAND & EASTERN.—This company has received a Dominion Government subsidy for a 100-mile line from a point on the Esquimault & Nanaimo branch of the Canadian Pacific, near Campbell River in the direction of Fort George.

WASIOTO & BLACK MOUNTAIN.—This company has been chartered in Kentucky by T. J. Asher, Robert Asher, G. M. Asher, M. Brandenburg; A. J. Asher, of Wasioto, Ky.; William Low, of Pineville, Ky., and R. W. Creech, of Wasioto. T. J. Asher & Sons, of Wasioto, are in the lumber business. Line to begin at a point 500 ft. south of milepost 205 on the Louisville & Nashville Railroad and will run up Cumberland River to Toms Creek, ten miles. See "Kentucky Southeastern Ry."

YANKTON SOUTHERN.—We are officially advised that surveys are now completed. Right-of-way and land for terminals in various towns and at tidewater have been 87% secured for its proposed line. It is announced that the prospects for construction are good. Company is not yet ready to state definitely when contracts will be let for the work. The projected route is from Yankton, S. Dak., south to David City, Neb., and Fairbury to Washington, Kan., thence south via Abilene, Newton, Wichita and Wellington to Atoka, Okla., thence via Palestine, Tex., Groveton, Onalaska and Fostoria to Houston, 1,007 miles. There are to be bridges over the Missouri, Platte, Canadian and Red Rivers. Fremont Hill is Pres., 422 Northern Bldg., Wichita, Kan. C. S. Corrigan is Ch. Engr., Galveston, Tex. Previously noted.

ELECTRIC RAILWAYS.

BOSTON, MASS.—Bids are asked by Lieut.-Col. Edw. Burr, Corps Engrs., U. S. A., Boston, until noon, Aug. 31, for furnishing and delivering electrical machinery, cable, rails, trolley and track material, etc.

WILLIMANTIC, CONN.—The Connecticut Co. has awarded the contract for constructing the Willimantic-South Coventry trolley line to LATHROP & SHEA, of New Haven, Conn. This extension is about five miles line. Estimated cost is about $50,000 a mile. Noted on July 23.

ROCHESTER, N. Y.—The Rochester, Charlotte & Manitou R. R., extending from Rochester to Lake Ontario, eight miles, has been sold by the Receiver, W. Butler Crittenden, to Kendall B. Castle, Attorney, Rochester, for $12,000, the purchaser assuming outstanding bonds of the company to the amount of $80,000, and receiver's notes for $8,000.

MAUCH CHUNK, PA.—Articles of reorganization of the Mauch Chunk Street Railways under the name of the Carbon Transit Co., were filed at Harrisburg recently. The company succeeds the Carbon St. Ry. Co., and has $150,000 capital, instead of $354,000 of the former company, whose rights and property is secured. H. D. Lentz, of Mauch Chunk, is Pres.

WEST CHESTER, PA.—At a recent meeting of the directors of the proposed electric railway line between West Chester and Pottstown, it was decided to construct and equip the road, at a probable cost of $600,000. The contract for constructing the railway was awarded to CHARLES F. GOLDSTROM, of Pittsburg.

ROANOKE, VA.—The Roanoke & Bent Mountain Ry. Co. has been granted a charter in Virginia to build a passenger and freight line from Roanoke to Floyd, Va., about 45 miles. Electricity probably will be the motive power. No contracts have yet been let. The officers are W. H. Price, Pres., Elliston, Va.; J. Coles Terry, First Vice-Pres., Bent Mountain, Va.; L. L. Greenwood, Second Vice-Pres., Cave Spring, Va.; S. G. Whittle, Jr., Secy. and Treas., Roanoke, Va. Directors: J. Coles Terry, Bent Mountain, Va.; J. C. Coles, Air Point, Va., W. R. West, Salem, Va.; L. L. Greenwood, Cave Spring Va.; Samuel R. Brame, Floyd, Va.

The Roanoke Traction & Light Co. has been chartered to build an electric railway connecting Roanoke, Clifton, Forge, Lynchburg and other points in Virginia, altogether about 200 miles of line. Authorized capital stock, $2,000,000. The directors are: James P. Woods, Pres.; R. C. Jackson, Vice-Pres.; James C. Martin, Secy. and Treas.; W. W. Coxe and Joseph H. Chitwood, all of Roanoke.

LAKE CHARLES, LA.—The Lake Charles Railway & Light Co., recently incorporated, has capital of $750,000, of which $250,000 is preferred stock and $500,000 common stock. Thompson J. Bird is Pres. The company is to take over the Lake Charles Street Railway Co. It may build or own street railways or interurban lines anywhere in Louisiana, besides operating light and power plants, sewerage plants, telephones, etc.

MEMPHIS, TENN.—M. J. ROACH, Scimitar Bldg., Memphis, has been awarded contract to build the line of the Lake View Traction Co. from Memphis, Tenn., to Lake View, Miss., twelve miles, to be completed by Jan. 1, 1909. Cost, including equipment, about $189,000. R. F. Tate is Pres., and W. W. Hayden, Ch. Engr., at Memphis, Tenn. Noted on June 25.

GRAND RAPIDS, MICH.—Construction of an electric line from Grand Haven, Mich., via Grand Rapids, to Fostoria, Ohio, with branch to Alpena, Mich., is assured by mortgage of $250,000 filed by the Grand Rapids Elec. Ry. Co. with the Cleveland Trust Co. J. W. Boynton is Pres. of the Grand Rapids Elec. Ry. Co.

TAYLORVILLE, ILL.—We are officially informed that the Taylorville Railway, Light, Heat & Power Co. will let construction contracts within 30 days for its proposed railway, which will be a local line, about four miles in length. Contract will include building a 250-KW. single-unit electric plant. Financial arrangements have been made, right-of-way secured and surveys made. The power station will be located at Taylorville and current will be sold for commercial purposes. Overhead trolley will be used. The company may operate an amusement park, about one mile from the city. Capital stock, $150,000. James H. Forrester, Taylorville, is Pres.; Henry Cheney, Taylorville, Vice-Pres.; James A. Adams, Secy., and W. B. Adams, Gen. Mgr.

JANESVILLE, WIS.—The Cincinnati Construction Co. has been incorporated in Janesville by J. M. Bostwick, M. P. Richardson, Archie Reid, P. H. Korst, Richard Valentine and H. H. Zigler, all of Janesville. The company will build an electric interurban railroad between Janesville and Madison. Joseph Ellis, Engr., of Columbus, has made preliminary survey of the line from this city to Stoughton. The road will run from Janesville to Madison by way of Edgerton and Stoughton. Capital stock, $25,000.

OSHKOSH, WIS.—The Oshkosh, Winneconne & Waupaca R. R. Co. has been incorporated in Wisconsin to build a railway from Oshkosh to Waupaca, through Oshkosh, Vinland and Winneconne in Winnebago County; Poy Sippi and Bloomfield in Waushara County; and Fremont, Weyauwega and Lind in Waupaca County, a distance of 50 miles. Capital stock, $100,000. Incorporators: William M. Bray, E. H. Steoger, Elmer Leach, Edward W. Murphy and L. J. Monahan, all of Oshkosh.

The property of the Winnebago Traction Co. has been sold for $950,000 under foreclosure proceedings in the case of the Trust Company of America. The purchasers were Oliver C. Fuller, Fred C. Best and Russell L. Smith, all of Milwaukee. It is the purpose to reorganize the Winnebago Traction Co. with Milwaukee and Oshkosh capitalists as stockholders, officials and directors and with Clement C. Smith, of Milwaukee, as Pres. An association of interests of the traction company and the Eastern Wisconsin Railway & Light Co. will be formed within a short time.

SPARTA, WIS.—The Sparta & Melrose Elec. Ry. & Power Co. has not decided when contracts are to be let for building its line. The projected route is from Sparta, Wis., northwest via Angelo, Trout Fall and Cataract to Melrose, 28 miles. There will be two long bridges, one over Black River. Noted on June 4.

RED OAK, IOWA.—The Red Oak & Northeastern Ry. Co. is surveying for its electric railway from Red Oak to Des Moines, through Greenfield, Stuart, Redfield, Adel and Waukee. The line will be about 100 miles in length. Water power probably will be used from the Raccoon and Nishnabotna Rivers. M. N. Spencer, Red Oak, is Secy.

NEVADA, MO.—C. C. McFann, Gen. Mgr. of the Kansas City & Springfield Southern Ry., advises us that no work will be begun by this company on its proposed line this year, owing to financial conditions. As noted on Jan. 9, "surveys have been made by this company, which proposes to build an electric railway between Nevada and Springfield, with a branch line to Carthage. The present capital stock is $3,750,000, to be increased to $4,500,000. The total length of the line, including sidings, will be 140 miles. Motive power will be electricity, to be furnished from a power station which is to be built near Arcola, Mo. The company will also own and control an amusement park near the Sac River." The officials of the Kansas City & Springfield Southern Ry. Co. are as follows: W. P. Forsyth, Pres.; S. A. Wight, Secy.; J. W. Creekman, Treas.; C. C. McFann, of Nevada, Mo., Gen. Mgr.

SPOKANE, WASH.—The Yakima Valley Transportation Co. will build 70 miles of electric railway, costing $2,000,000. It is headed by J. Splawn, North Yakima. G. S. Rankin, Pres. of the Yakima Trust Co., is Vice-Pres.; Murray B. Miles is Secy. and E. M. Kenley is Ch. Engr. and Supt. Preliminary surveys have been made, right-of-way secured, capital has been subscribed and some material has been ordered, it is reported. The first extension of the line will be to the Washington State fair grounds, southeast of North Yakima. Thence the road is to be continued south to Yakima City, thence across the Yakima River and through Union Gap toward Parker and Zillah. Eventually it will be extended to Granger and Sunnyside. Previously noted.

PORTLAND, ORE.—The Coos Bay Railway & Terminal Co. has filed articles of incorporation at Portland. Company is organized under the laws of Washington. The officers are: Henry Hewitt, Jr., Pres.; L. J. Simpson, of North Bend, Ore., Vice-Pres.; Seymour Bell, of Marshfield, Secy. and Mgr. Capital, $250,000. It proposes to build an electric railway around Coos Bay and down the coast south of Sunset Bay. Mr. Hewitt and his associates bought the gas works and street railway system on Coos Bay some time ago, and are rebuilding and enlarging both plants.

QUINCY, CAL.—A franchise has been granted by the Board of Supervisors for the Quincy & Eastern Railroad to A. W. Rutledge, of Oakland. The line is projected to be built through American Valley from Quincy to the Western Pacific Railroad. It is to be completed on or before Jan. 1, 1909. It is to be a standard-gage road, with either steam or electricity as motive power.

OAKLAND, CAL.—The Board of Supervisors has decided provisionally to grant permission to A. W. Maltby and Joseph Naphtaly to operate an electric street railway through the Alameda County part of the Alameda-Contra Costa tunnel, back of Claremont. The conditions imposed were that the franchise be limited to five years, that the railway company provide gates at the entrances to the tunnel to exclude vehicles when trains are passing through the bore; to keep a watchman night and day at each end of the driveway; to maintain and operate semaphores; to keep the tunnel illuminated all the time, and to keep the roadway and side and arch walls in good condition at all times. A cash rental for the use of the tunnel will also be exacted. Final action on the application will be taken at the next meeting of the board, when a resolution, embodying the conditions enumerated, will be presented to the applicants by District Attorney Brown. Noted on May 28.

ST. THOMAS, ONT.—James Bell, City Engr., has submitted an estimate of the cost of extending the city electric railway line to Port Stanley. His figures did not include equipment, and the power to be used would be utilized from the Niagara power line. The roadbed would cost $6,638 per mile for seven miles, which would total $46,466; $3,000 added for bridges and $1,500 for turnouts would bring the total cost to $51,200. The overhead construction would amount to $11,690 for seven miles at the rate of $1,670 per mile, and adding $5,000 for incidentals the total outlay would be $67,950.

EDMONTON, ALTA.—The City Council has made arrangements to take over the charter of the Strathcona Radial Tramway Co. and will at once start construction of a municipal street railway system here and across the river in Strathcona. It is estimated that $125,000 will be spent for construction work and for the operation of the electric railway in Edmonton and Strathcona before the end of the year.

LIGHT AND POWER PLANTS.

NORTH ANSON, ME.—Work will begin soon on the concrete and timber dam, 200 ft. long, to be erected by the Franklin Power Co., at Cleveland Rips, on the Carrabasset River, in North Anson. The power developed will be used in the generation of electricity for illuminating and manufacturing purposes in several Franklin County towns. It is expected that the current will be available for use in Farmington in October.

MANCHESTER, N. H.—Plans are being considered to install an electric light plant to furnish electricity and power in the new sanatarium at Glencliff. Water power will be utilized to generate electricity. The Board of Trustees consists of Albert J. Precourt, of Manchester, N. H., and Senator Shedd, of Keene, N. H.

MONTPELIER, VT.—The Barre & Montpelier Traction & Power Co. has awarded the contract to build its dam and power-house on the Winooski River, to the DORNSIFE & MIGHLIERINI CO., of Montpelier, which will begin work at once. The dam will be 18 ft. high, of concrete, 145 ft. spillway and six foot penstock, 3,000 ft. long, providing 60 ft. head and furnishing 1,000 HP. There will be a steam auxiliary plant. The plant will furnish power to run the electric road. I. M. Frost is Gen. Mgr.

EASTHAMPTON, MASS.—The Easthampton Gas Co. is contemplating the installation of a 100-KW. alternating current, 3-phase generator and switchboard panel in its electric plant. George L. Manchester is Treas. and Mgr.

PROVIDENCE, R. I.—A motor generator station 1½ stories in height will be erected at once by the Narragansett Electric Lighting Co., at 146 and 148 Dyer St., adjoining the location of the present battery station. The contract calls for the completion of the new building within the next 45 days. The structure will contain four 1,000-KW. motor generators for converting alternating into direct current. The WESTINGHOUSE CO. has secured a contract also for a 3,500-KW. steam turbine capable of carrying a 50% overload for two hours and a 25% overload for 24 hours. The total cost of the new building and machinery will approximate $75,000. The station will measure 117 × 23 ft. and will be of brick, with a flat tar and gravel roof. R. P. Jenks designed the plans and HARDING & HAMLYN are the builders.

ROCHESTER, N. Y.—The Rochester Ry. & Light Co. will install oil-burning apparatus at its steam power plant on the river flats, north of Platt St. bridge, for the purpose of eliminating smoke. Crude oil will be used, and a storage tank, with a capacity of 1,000,000 gallons, will be constructed. Work will be commenced about Oct. 1. R. M. Searle is Gen. Mgr. of the company, Main and North Clinton Sts.

BUFFALO, N. Y.—The following are reported to be the bids opened by the Board of Supervisors for the installation of an electric lighting plant at the 74th Regiment Armory: Lazier Gas Engine Co., $7,750; Riverside Gas Engine Co., $7,400; Dubois Engine Co., 160 HP., $6,762; Bruce Marion-Abbott Co., engine complete, $6,400; also three other bids by this company, $6,903, $6,620 and $6,481; Robertson Electrical Constr. Co., $8,600; Fairbanks-Morse Co., complete with switchboard, $7,500; A. H. Alberger Co., with switchboard, $8,142; J. C. Stearns Electric Co., $8,400, and Struthers-Wells Co., (two bids), $7,275 and $7,125.

PHILADELPHIA, PA.—Plans for a power-house to be built for the Girard Estate, at 20th St. and Oregon Ave., have been posted for estimates in the office of Jacob Myers & Sons, Witherspoon Bldg. It will measure 88 × 72 ft., and will be constructed of reinforced concrete and steel. The building will supply light and heat to houses about to be built by the Girard Estate in the neighborhood.

SCRANTON, PA.—Work will be begun at once upon the foundations of the proposed power-house to be built by the Scranton Ry. Co., in the rear of the present power-house on Providence Road. P. T. Reilly, Scranton, is Supt.

ELLWOOD CITY, PA.—At a cost of $25,000, the Ellwood Power Co. will increase the capacity of its dam in the Connequenessing River south of the city. The old dam will be entirely rebuilt, and with the new one, water can be held back at a distance of more than eight miles. G. E. Seiler is Mgr.

WILMINGTON, DEL.—R. & S. SOLLITT, Pullman Bldg., Chicago, Ill., have the general contract for reconstruction of a power-house, at Wilmington, for the Pullman Co., Chicago. Cost, $30,000.

WASHINGTON, D. C.—Elliott Woods, Supt. of the U. S. Capitol Building and Grounds, Washington, D. C., has awarded contract for the electric lighting fixtures for the new Senate Office Building, to the MITCHELL VANCE CO., 507 West 24th St., New York, at $35,521.

FREDERICKSBURG, VA.—William C. Whitner, Hydraulic Engr., of the Virginia Passenger & Power Co., and Pres. of the Fredericksburg Power Co., has announced that construction work on the dam across the Rappahannock River, above Fredericksburg, will begin shortly. The dam will be built of solid concrete, reinforced with steel; 800 ft. long and 22 ft. high. It will be built about 50 yds. below the site of the present dam, and will increase the capacity from 2,000 to about 8,000 HP. The dam which will cost $50,000, will be completed about Jan. 1.

ROANOKE, VA.—The Roanoke Railway & Electric Co. has engaged J. J. Kennedy as engineer to prepare plans for the development of a water power at Little Tunnel on the James River.

MARTINSBURG, W. VA.—The Martinsburg Power Co., of Martinsburg, W. Va., has let the contract for the erection of the power plant at Dam No. 4 to W. M. KEFAUVER and ARTHUR L. SHREVE, of Baltimore, Md.

FORT SCREVEN, GA.—The ELECTRIC SUPPLY CO., Savannah, Ga., has contract to install an electric lighting and power system in batteries, torpedo structures and range stations at Fort Screven. Col. Dan C. Kingman, Corps Engrs., U. S. A., is in charge of Savannah District.

ELBA, ALA.—Plans are being considered by the Pea River Power Co. to erect a 3,000-HP. plant on the Pea River at Elba. H. D. Boyd is Secy. and Treas.

NEW ORLEANS, LA.—The New Orleans Gas Light Co. has awarded contract to the STACEY MFG. CO., Cincinnati, O., for construction of 4-lift 1,020,000-cu. ft. gas holder and tank for storing gas. Cost, including foundation, complete, $125,000. Joseph H. DeGrange is Secy.

HAMILTON, OHIO.—Plans are being prepared for the construction of a new electric power plant to be operated by the Hamilton Hydraulic Co. It is stated that the power plant will be owned by the Hamilton estate and will be located in this city at the corner of Front and Buckeye Sts. Work will commence on the construction of the plant as soon as plans are prepared. The plant will be under the management of T. Jones, Supt. of the Harding Paper Mill, of Excello, Ohio. Frederick G. Mueller is Ar[illegible]

MARION, IND.—Plans are being made to enlarge and rebuild the municipal electric light plant. New equipment will be installed. The city is preparing to supply electricity for commercial purposes. Otis W[illegible]ner is Supt.

MENOMINEE, MICH.—JACOBSON & DE GUERE, Grand Rapids, Mich., have secured contract for plans, specifications and supervision of a 7,000-HP. hydro-electric power plant for the company to be located at Grand Rapids, on the Menominee River, about 18 miles north of Menominee, for the Menominee & Marinette Traction Co. The plans call for a solid concrete dam about 500 ft. long, a dike of 1,000 ft. long, a reinforced concrete power-house and flume, a canal on the opposite side of the river leading to the power-house about 4,000 ft. long. It is not definitely decided how many and what capacity units will be installed.

MARSEILLES, ILL.—The Marseilles Land & Water Power Co. contemplates construction of a new power-house and installing two 600-KW., 2,300-volt, 60-cycle, 3-phase generators; also the extension of its transmission lines to Ottawa. D. J. McLeod is Supt.

MADISON, WIS.—The lowest bid received on July 30 by the State Capitol Commission for electric fixtures for the new west wing of the Capitol, was submitted by the Mitchell-Vance Electric Co., of New York, N. Y., for $30,000. The ALPHONS CUSTODIS CHIMNEY CONSTRUCTION CO., of Chicago, Ill., has secured the contract for building the 254-ft. chimney on the separate heating and power plant for the State Capitol, at $17,000.

KENOSHA, WIS.—Bids will be received by George W. Harrington, City Clerk, until Sept. 8 for furnishing electricity for lighting the streets of the city for a term of five and for ten years from Aug. 20, 1909, the contract to provide for 155 or more arc lamps of 2,000 c. p. Bids to be submitted for an all-night and also for a moonlight schedule.

EAGLE GROVE, IOWA.—Plans are being considered for increasing the output of the Citizens' Light, Heat & Power Co.'s plant. The plans include the installation of an additional boiler, the replacing of the present direct-current dynamo with a larger machine, or the addition of an additional generator. J. A. Innes is Secy. and Mgr.

MASON CITY, IOWA.—We are officially advised that the Farmers' Co-operative Brick & Tile Co., of Mason City, Iowa, have let the contract to the MINNEAPOLIS STEEL & MACHINERY CO., 2854 Minnehaha Ave., Minneapolis, Minn., for their complete power plant, including 20 × 48-in. heavy duty Twin City Corliss engine, three 72-in. × 18 ft. horizontal return tubular boilers, 500-HP. feed water heater, and triplex boiler feed pump.

BUHL, MINN.—The contract for improvements to the municipal electric light plant and water-works system has been awarded to R. B. WHITACRE & CO. of St. Paul, Minn., for $22,013.

ALEXANDRIA, MINN.—The contract for reconstructing the electric light and water plant and system has been awarded to J. G. ROBERTSON, 29 Gilfillan St., St. Paul, for $22,591, not including stokers and pole line. Edwin P. Burch, Guaranty Bldg., Minneapolis, is Engr.

CARTHAGE, MO.—The Empire Electric Power & Supply Co. has acquired a water power about six miles from Carthage, and will install water wheels and alternators, and erect a 3-phase transmission line to supply electricity to operate the local system. R. J. Claflin is Secy.

DUNCAN, OKLA.—Plans are being considered by the Duncan Light & Ice Co., to increase the equipment of its plant, including the installation of a 100-KW., direct-current, 3-wire, 250-volt generator direct connected. W. L. Bumpass is Secy. and Mgr.

STILWELL, OKLA.—We are officially advised that the city of Stilwell, Okla., has granted to the Stilwell Public Service Co., ordinances for the installation of an electric light plant and water-works. Work is to begin immediately on construction of the plants, under the supervision of BURNS & CO., Isabella Bldg., Chicago, Ill., who have the general contract and will purchase all material and let sub-contracts. Electrically operated pumping machinery will be wanted in particular.

LAS CRUCES, N. MEX.—The falls of the Rio Grande, 4½ miles above the Selden diversion dam have been located by a company composed of local interests with the intention of harnessing the power and generating electrical power for use in the valley, Las Cruces and El Paso. The location papers, accompanied by photographs of the falls, have been filed in the courthouse. The preliminary surveys have been made by J. N. Conners and a profile map has been made of the country surrounding the falls. A power plant will be erected at the falls and all the necessary machinery installed for utilizing the hydraulic power generated by the water. An auxiliary plant operated by steam will also be put in to provide power in case the river should run low. The generated power will be distributed to all parts of the valley by means of heavy feed wires.

The mines in the Organ Mountains and El Paso will be connected with the main plant according to the plans of the promoters. The persons interested in the project are: Martin Lohman, [illegible] Bowman, V. C. May, Isidore Armijo, Charles E. Miller and others.

TACOMA, WASH.—Bids will be received until Sept. 10 by H. J. McGregor, Comr. of Public Works, for a hydro-electric light and power plant.

BREMERTON, WASH.—The Navy Department has awarded the contract for the erection of a steel frame for the power plant building of the Bremerton Navy Yard, to the BROWN-KETCHUM IRON WORKS, of Indianapolis, Ind., at $16,760. The complete list of bidders was given on July 23.

SEATTLE, WASH.—We are officially advised that the contracts for installing cluster lights on First Ave., etc., have been let as follows: Division 1—Clearing, excavating, paving, manholes, concrete work, conduits, etc., STREHLOW, FREEZE & PETERSON, Seattle, $30,445. Division 2—Pole furnishing, cables, transformers, etc., AGGUTER-GRISWOLD CO., Seattle. Division 3—Cast iron lamp-poles, OLYMPIC FOUNDRY CO., Eighth St., South and Plummer Sts.

FRESNO, CAL.—The City Engineer has prepared an estimate of cost of lighting the business section of the city with electroliers, replacing the present hanging arc lights. Estimated cost of 308 lights is $38,500. The wiring will reach $7,700, making total cost of installation of $46,200.

BURLINGAME, CAL.—Baldwin & Howell, have awarded the last contract for the Hayward Park Division 111, San Mateo, to the U. S. GAS & ELECTRIC CO., which provides for the installation of a complete electric lighting system, laying gas and water mains, etc.

*MORENCI, ARIZ.—See under Bridges.

MINIDOKA, IDAHO.—The Secretary of the Department of Interior, of Washington, D. C., is reported to have awarded contracts for electrical apparatus for use in connection with power plant, Minidoka Irrigation project, Idaho, as follows: GENERAL ELECTRIC CO., Schenectady, N. Y., $7,660; S. MORGAN SMITH CO., York, Pa., about $11,500; WESTINGHOUSE ELECTRICAL & MFG. CO., of Pittsburg, Pa., $115,500; the ALLIS-CHALMERS CO., of Milwaukee, Wis., two contracts about $101,517 and $39,710, respectively.

LETHBRIDGE, ALTA.—The City Council has adopted the recommendation of the special committee to purchase the plant of the Lethbridge Electric Co. The city proposes to remove the plant to the pumping house site, where it will be enlarged and improved and the whole system extended, involving an expenditure of about $150,000.

BRIDGES.

(denotes that this work is advertised in Engineering News.)*

*WOONSOCKET, R. I.—Plans and specifications are on file at the office of Engineering News, New York, for constructing a stone arch or a concrete and steel arch bridge in Sayles St., over the Blackstone River. Bids are asked until Aug. 21.

FORT HUNTER, N. Y.—The Highway Commissioners will build a bridge over the Schoharie River. Estimated cost, $25,000. Bids will soon be asked.

BUFFALO, N. Y.—The New York Central R. R. Co. has had plans prepared and bids will soon be asked for the following steel viaducts to be erected in Buffalo; one at Elk St., over the New York Central R. R. dock line tracks, 300-ft. span, 56-ft. roadway; one at Kensington Ave., over New York Central R. R. belt line tracks, 75-ft. span.

ITHACA, N. Y.—Plans are being prepared in the office of Frederick K. Skene, State Engr., Capitol Bldg., Albany, N. Y., for the construction of the three steel bridges here at the following streets: Buffalo St., State St. and Seneca St. Bids will soon be asked by the State Commissioner of Public Works. The appropriation for the work is $125,000.

HACKENSACK, N. J.—The Board of Freeholders on Aug. 4 adopted the plans and specifications for the new drawbridge on the Turnpike over the Hackensack River. The plans will have to be submitted to the War Department for approval and if the sanction of the federal officials is received in time the clerk will advertise for bids to be received at the meeting of the board on September 3.

ATLANTIC CITY, N. J.—The contract for constructing a steel bridge over Egg Harbor River at 12th St. in Buena Township, has been awarded to the NELSON-MERIDITH CO., of Atlantic City at $3,564. Bids were opened on Aug. 5. E. D. Rightmire is County Engr.

LANCASTER, PA.—J. P. BRENEMAN, of Lancaster, has secured the contract for constructing a steel plate girder bridge over the railroad tracks on W. James St., at $3,375. Bids were opened on Aug. 4. J. S. Carpenter is City Engr.

WILLIAMSPORT, PA.—Bids are asked until Aug. 18 by the Board County Commissioners at Williamsport, for constructing two concrete steel bridges, one across Lawree Run, Moreland Township, and the other across Larry's Creek, Mifflin Township, each to have a clear span of 34 ft. 6 in. and a 14-ft. roadway; also for constructing the abutments for the bridge across Munsy Creek at Picture Rocks, and taking down the present 184-ft. span across the Susquehanna River at Jersey Shore and erecting at Picture Rocks such parts of the span as are necessary. John R. Smith is Chn. Bd.

EASTON, PA.—The Commissioners of Lehigh and Northampton Counties on Aug. 6, awarded the contract for the Broad St. bridge, Bethlehem, to CRAMP & CO., Commonwealth Bldg., Philadelphia, Pa., the lowest of five bidders, at $104,000.

BALTIMORE, MD.—B. T. Fendall, City Engr., is preparing plans for the construction of a concrete bridge over Gwynn's Falls at Hollins St. Estimated cost, $11,500.

CUMBERLAND, MD.—WILLIAM FARRIS & BROS., 204 Diamond Bank Bldg., Pittsburg, Pa., have been awarded the contract at $14,000 instead of $4,000, as incorrectly stated on July 30, for work on Wiley's Ford bridge over the Potomac River at South Cumberland, including flooring and 700 yds. of concrete, on which proposals are being received.

RICHMOND, VA.—The city has awarded the contract to A. M. WALKUP, Richmond, at $4,500 for repairs to the Free bridge across the James River, consisting of building four bents under each of the main chords of eight weak spans.

COLUMBUS, GA.—The city will have plans prepared by Edwin Tacher; Pres. Concrete-Steel Engineering Co., Park Row Bldg. New York for the construction of a bridge across Chattahoochee River at Dillingham St. Estimated cost $110,000. The Melan system of steel arch construction will be used. W. C. Campbell is Supt. Pub. Wks.

*ATLANTA, GA.—Plans and specifications are on file at the office of Engineering News, New York, for the erection of a reinforced concrete viaduct on Ponce de Leon Ave. Bids are asked until Aug. 20.

PENSACOLA, FLA.—The Escambia County Commissioners contemplate constructing three bridges in connection with the road improvements to span the Perdido River, Bayou Chico and Escambia River.

PINOLO, MISS.—The CONVERSE BRIDGE CO., Chattanooga, Tenn., has been awarded the contract for the construction of a steel bridge over the Stang River near here, at $4,283.

WEATHERBY, MISS.—The contract for the construction of a steel bridge over the Pearl River at Mahoffy's ferry has been awarded to the CONVERSE BRIDGE CO., of Chattanooga, Tenn., at $8,362.

*BENTON, TENN.—We are officially advised that bids were received as follows by the County Clerk on Aug. 3, for the construction of three steel highway bridges in Polk County, separate bids being received for the substructures of all bridges complete, and for the superstructure of each bridge separately, the concrete work aggregating about 2,000 cu. yds. and the steel about 45,000 lbs. Substructures: S. M. MONDAY, Knoxville, Tenn., $8.24 per cu. yd. awarded contract; Walton, Wilson Rodes Co., Knoxville, $8.95; J. J. Conner & Bro., Knoxville, $9.15; Landers, Amburn & Leighon, Copper Hill, Tenn. $11.15. This is concrete work and the price covers excavations, cofferdams, etc., and will be the basis of total payment on 2,100 cu. yds. Superstructures: (A) Hiwasse Ave., (B) Ocoll Ave., (C) Potato Ave.: CONVERSE BRIDGE CO., Chattanooga, (A) $10,519, (B) $12,597 (awarded contract), (C) $3,113 (awarded contract); JOLIET BRIDGE & IRON CO., Joliet, Ill., (A) $10,028 (awarded contract), (B) $12,667, (C) $3,215; American Bridge Co., 42 Broadway, New York, (A) $10,560, (B) $14,120, (C) $3,500; Roanoke Bridge Co., Roanoke, Va., (A) $12,541, (B) $18,359, (C) $3,205. B. H. Case, Asheville, N. C., is County Engr.

MT. GILEAD, OHIO.—Bids are asked until 11.30 a. m., Aug. 14, by W. C. McFarland, County Audr., for constructing the sub and superstructure of a steel bridge 89 ft. long in Johnsville.

COLUMBUS, OHIO.—Bids are asked until noon, Aug. 28, by the County Commissioners for bridge work. F. M. Sayre, County Audr.

DAYTON, OHIO.—The contract for the construction of a concrete bridge over Hole's creek on the Miamisburg and Centerville Pike was let by the County Commissioners on July 30 to JAMES MANUEL at $4.44 per cu. yd.

IRONDALE, OHIO.—Bids are asked by the County Commissioners until noon, Aug. 28, for the construction of the substructure of bridge No. 13, Salina Township, near here. J. M. Reynolds is County Audr.

*SPRINGFIELD, OHIO.—Bids are asked until noon, Aug. 25, by the Board of Public Service for the construction of a bridge across Buck Creek and the Ansted-Burk Co. head race at Sherman Ave. and Nelson St.

Bids for the above work were rejected on July 28 on account of the informality in some of the bids submitted. William H. Mahoney is Clk. Bd. Pub. Service.

ST. CLAIRSVILLE, OHIO.—Bids are asked by A. W. Beatty, County Audr., until Aug. 31 for constructing the substructure and superstructure of several county bridges.

LAKEWOOD (Cleveland post-office), OHIO.—Plans and specifications are on file at the office of Engineering News, New York, for constructing the substructure and superstructure of a steel foot bridge. Bids are asked until Aug. 17.

COLUMBUS, IND.—The Board of Commissioners will soon ask for bids for the repair of the iron work and the reflooring of the White River bridge which is 525 ft. in length.

INDIANAPOLIS, IND.—Bids are asked by the Commissioners of Marion County until Aug. 29, for the construction of three concrete culverts in Decatur Township, and one each in Wayne and Franklin Townships.

MAHOMET, ILL.—Bids are asked until 2 p. m., Aug. 18, by the County Commissioners, at Urbana, Ill., for erecting a 144-ft. highway bridge on concrete abutments, four miles north of Mahomet. Plans and specifications may be seen at the office of Ira O. Baker, Champaign, Ill.

YPSILANTI, MICH.—Benjamin Douglas, of Detroit, Mich., is preparing plans and specifications for a new concrete bridge at Race St. Estimated cost, about $10,000.

MILWAUKEE, WIS.—Bids are asked by the Board of Public Works until 10.30 a. m., Aug. 20, for constructing a bascule bridge across the Milwaukee River at East Water St., Charles J. Poetsch is Chn. Bd.

ISANTI, MINN.—The A. Y. BAYNE CO., Minneapolis, Minn., has been awarded the contract at $5,100, for constructing a steel bridge over Rum River in Isanti Village.

*MISSOULA, MONT.—Bids, plans and specifications are asked until 10 a. m., Sept. 1, by W. H. Smith, County Clk., for the construction of a combination wagon and foot bridge across the Missoula River, on Higgins Ave., a bridge to be 32 ft. roadway, with a 10-ft. sidewalk on each side, and of length as shown on profile now on file in the office of the Clerk and Recorder of Missoula County.

Plans, specifications and sealed bids will be received for both reinforced concrete and concrete piers and steel superstructure. The material used in construction of roadway must be other than wood.

CONWAY, ARK.—The MORAVIA CONSTRUCTION CO. has been awarded the contract for constructing five steel bridges at $6,720. James A. Lea, County Judge.

MARLIN, TEX.—Falls County has voted $50,000 of bonds to construct a bridge over the Brazos River at Belton Crossing and to repair High Bank bridge over the same river. John Wharton Maxcy, Binz Bldg., Houston, Tex., is Engr.

BLUE, OKLA.—Bids are asked by the Bryan County Commissioners, J. M. Abbott Chn., Durant, Okla., until Aug. 20, for furnishing and erecting the superstructure of two 130-ft. span steel bridges over the Blue River, one near Blue, Okla., and the other near Bokchito, Okla.; also for the constructing of the concrete foundations and abutments and steel tubular piers for said bridges. Bids for abutments and bridges may be submitted together. Plans and specifications are on file in the office of the County Clerk at Durant.

HOLDENVILLE, OKLA.—The Hughes County Commissioners have awarded the contract to the MISSOURI VALLEY BRIDGE & IRON CO., Leavenworth, Kan., for the construction of three steel bridges—one near Wetumka, another near Spaulding and third near Citra, Okla., reinforced-concrete piers, length of structures 511 ft., 205 ft. of steel and 306 ft. of wood approach, at about $4,790, excepting fills.

HOQUIAM, WASH.—The construction of a steel bridge over the Hoquiam River, to cost about $75,000, is contemplated.

SAN BERNARDINO, CAL.—The City Engineer has been instructed to prepare plans and specifications for the construction of several bridges.

*MORENCI, ARIZ.—Bids are asked until 9 a. m., Sept. 16, by the Morenci Water Co., C. P. Chester, Supt., for furnishing all labor and material and erecting one light steel truss bridge, 190 ft. long, one steel frame corrugated iron powerhouse building, 65 ft. by 80 ft; one steel oil tank, 50,000 gallons capacity; auxiliary water tank and miscellaneous steel work.

EDMONTON, ALTA.—A contract has been let to JOHN GUNN & SON, Winnipeg, Man., for the construction of the steel and concrete bridge across the Pembina River west of here. The bridge will be 1,000 ft. long and 230 ft. high.

BUILDINGS.

(denotes that this work is advertised in Engineering News.)*

*PORTSMOUTH, N. H.—Bids are asked until 11 a. m., Sept. 5, by R. C. Hollyday, Ch. Bureau Yards and Docks, Navy Dept., Washington, for 160 naval prison cells with plumbing, piping, ventilators, cots, gratings, and stairs, at the Navy Yard, Portsmouth.

NORTHAMPTON, MASS.—Plans have been completed by Land & Hewlett, Archs., 16 East 23d St., for a library building to be built here for Smith College at about $150,000.

SPRINGFIELD, MASS.—HOGGSON BROS., 81 Church St., New Haven, Conn., have secured the contract to erect the 3-story brick and terra cotta Y. W. C. A. Bldg., on Howard St. Estimated cost $100,000. E. C. & G. C. Gardner, 33 Lyman St., Springfield, are Archs.

CENTRAL FALLS, R. I.—Bids are asked until Aug. 25 by Fontaine & Kinnicutt, Archs., Commercial Bldg., Woonsocket, R. I., for constructing a school for the Parish of Notre Dame, Central Falls. The building will be three and four stories high, of brick and steel construction and will cost $75,000; equipment, $15,000.

BUFFALO, N. Y.—The Evangelical Memorial Congregation will build a 1-story and basement church of brick, stone and structural steel with slate roof. It will be built at East Utica St. and Wohler's Ave., and will be 64 × 80 ft. John H. Coxhead, 928 Ellicott Square, is Arch.

BATAVIA, N. Y.—The Masonic Building Association, W. G. Pollard, Ch. Bldg. Com., will erect a 3-story and basement temple, lodge, store and office building, 73 × 68 ft. of pressed brick with stone trimmings, at a cost of $40,000. Robert North, 1326 Prudential Bldg., Buffalo, N. Y., is Arch., and will receive bids at once.

NEW YORK, N. Y.—Bids are asked by Robert W. Hebberd, Comr. of Public Charities, until 2.30 p. m., Aug. 24, for erecting a nurses' home and training school, Kings County Hospital, Boro. of Brooklyn.

NEW YORK, N. Y.—Approval has been given by the Building Superintendent to the plans of a $10,000,000 office building for the Equitable Life Assurance Society to replace its present structure at 120 Broadway. The plans, filed on June 29, by D. H. Burnham & Co., Archs., Railway Exchange Bldg., Chicago, provide for a 62-story building, covering the block bounded by Nassau, Pine and Cedar Sts. and Broadway.

Plans have been filed with the Building Superintendent by Clinton & Russell, 32 Nassau St., Archs. for the Broad Exchange Co., for adding a new full story to the office building of the company at 25 to 33 Broad St., making it 21 stories high. The cost of the addition is estimated at $80,000.

NEW YORK, N. Y.—We are officially advised that the Washington Heights Development & Construction Co., 103 Park Ave., is taking estimates for construction of a 6-story apartment house to be erected at Audubon Ave. and 177th St. The building will be 85 × 100 ft., and will cost, $250,000. Mulliken & Moeller, 103 Park Ave., are Archs.

Contract has been let by A. S. Hedman, Arch., 373 Fulton St., to JOHN H. DEEVES & BROS., 103 Park Ave., for a 4-story hotel for F. W. Whitridge, receiver for the Third Avenue Ry. Cost, $100,000.

Bids are asked by C. B. J. Snyder, Supt. of School Bldgs., Dept. of Education, until 3 p. m., Aug. 19, for fire protection, etc., at Public School No. 16, Wilson, near Bedford Ave., and Public School No. 35, N. B., Decatur St., near Lewis Ave., Boro. of Brooklyn; for fire protection, etc., at Public School No. 73, McDougal St. and Rockaway Ave., Boro. of Brooklyn; for alterations, repairs, etc., at Manual Training High School, Girls' High School and Public Schools Nos. 9, 10, 17, 31, 32, 39, 77, 82, 85, 92, 100, 106, 107, 113, 142, 143, Boro. of Brooklyn. The plans of McKim, Mead & White, 160 5th Ave., New York City, for the New York City post-office have been approved by Beekman, Winthrop, Acting Secy., Treasury Dept., Washington, D. C. After their approval by the Postmaster General and the Secretary of the Interior, detailed plans for the structure will be made.

NEW YORK, N. Y.—We are advised by N. Serracino, Arch., 1123 Broadway, New York, that he has been commissioned by the Rector of the Church of the Resurrection, to prepare plans and specifications for a church, school and rectory to be built on 151st St., between 7th Ave. and McComb's Pl., New York.

Following is a list of the low bidders for fire protection on various public schools, Boro. of Brooklyn, received by C. B. J. Snyder, Supt. School Bldgs., Dept. of Education, on Aug. 3: William Werner, 892 Forest Ave., School No. 44, $35,900; Clark & Stowe, 221 Greenpoint Ave., Brooklyn, School No. 26, $13,900, school No. 34, $7,700; school No. 45, $7,400; school No. 46, $5,790; school No. 49, $6,700; school No. 51, $4,400; school No. 53, $6,800; school No. 71, $5,700; school No. 74, $16,700; school No. 79, $6,300; school No. 82, $13,700; school No. 83, $10,400; Christopher Nally, 2382 Broadway, school No. 73, $19,800; William Werner and Clark & Stowe, school No. 86, each $13,900.

*WEST POINT, N. Y.—Bids are asked until noon, Aug. 24, by the Quartermaster for work on the Cadet Mess Hall and Cadet Hospital at West Point.

WOODBURY, N. J.—The Woodbury Board of Education has awarded the contract for the proposed high school building to JOSEPH STEELMAN, of Bridgeton, N. J., for $53,173, exclusive of the heating plant, which will cost $6,000.

TRENTON, N. J.—We are officially advised that Spencer Roberts, Arch., Weightman Bldg., Philadelphia, has plans for a 3-story city hall, 214.2 × 72.1 ft. to be built of either granite or marble, at Trenton. Estimates will be received until Aug. 24.

FAIRVIEW, PA.—The State Commission has rejected all bids received last month for the erection of a hospital for the criminal insane at Fairview, Wayne County, and has ordered the proposals readvertised. The reason given for the rejection of the bids was that they were too high. The proposals called for the erection of two buildings, to be known as No. 4 and No. 8, and ranged in amount from $37,000 to $52,000 for the smaller structure and for the larger building from $81,000 to $108,000. The site of the proposed hospital embraces 640 acres on the top of a mountain 2,200 ft. above sea level about twelve miles from Carbondale.

WILKINSBURG (Pittsburg post-office), PA.—The School Board of Wilkinsburg will select an architect for the proposed high school on Aug. 17. The building will cost about $200,000 and it is expected work will be started this fall.

WILKES-BARRE, PA.—Owen McGlynn, Arch., Simon Long Bldg., has prepared plans for a 4-story and basement high school building, 144 × 214 ft. to be built here at a cost of $300,000.

PITTSBURG, PA.—We are advised by J. L. Beatty, Arch., 146 Sixth St., Pittsburg, that he is preparing plans for a hospital building, a power house and a nurses' dormitory to be built by the West Pennsylvania Hospital Association. The buildings will have an irregular shape, about 225 × 320 ft. and will be fireproof. They will have three, four and six stories and will cost about $600,000. Bids will be received in about two months.

Bids are asked by D. H. Burnham & Co., Archs., Railway Exchange until Aug. 15, for building a bank and office building for the First National Bank of Pittsburg. Cost, $1,500,000.

BRYN MAWR, PA.—The contract to erect the country residence for Walter D. Blabon, at Bryn Mawr, is reported awarded to BALLINGER & PERROT, 1200 Chestnut St., Philadelphia, at about $50,000.

WASHINGTON, D. C.—Bids are asked until noon, Aug. 15, by the District Commissioners, for construction of administration building, workhouse for males and combination boiler and kitchen building, including heating and ventilation, located on Reservation No. 13, 19th and B Sts., S. E.

*WASHINGTON, D. C.—Bids are asked until 2 p. m., Sept. 8, by B. T. Gallaway, Chn. of Com. on Bldgs., Dept. of Agriculture, Washington, for the installation of a vacuum cleaning system of two laboratory buildings for the U. S. Department of Agriculture, Washington.

*WASHINGTON, D. C.—Bids are asked by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p. m., Sept. 17, for an extension of the bond vault in the U. S. Treasurer's Office, in the U. S. Treasury Department Building, Washington, D. C.

*FORT MONROE, VA.—Bids are asked until 10 a. m., Sept. 3, by Capt. Ernest R. Tilton, Constr. Q. M., for the construction of one library for Coast Artillery School, one barracks, one double-set non-commissioned officers' quarters and two double sets firemen's quarters, including plumbing, heating, electric wiring and fixtures and book stacks at Fort Monroe, Va. Bid for book stacks may be submitted separately.

PENSACOLA, FLA.—The contract to erect the 10-story bank and office building for the American National Bank has been awarded to the SELDEN-BRECK CONTRUCTION CO., Fullerton Bldg., St. Louis, Mo., at about $300,000. Carpenter, Blair & Gould, 475 Fifth Ave., New York, are Archs.

NEW ORLEANS, LA.—J. H. Goodman proposes to organize company with $200,000 capital stock to purchase the St. Louis Hotel property for $200,000 and convert it into an auditorium. The first floor will be used as stores and upper floors as an auditorium.

MEMPHIS, TENN.—OLSEN & LESH, 123 Madison St., have the contract for the completion of the Y. M. C. A. building to cost $160,000.

Jones & Furbringer, Archs., Dr. D. T. Porter Bldg., have completed plans for a church for the First Church of Christ (Scientists), Rev. Edward Stapleton, Pastor. Estimated cost, $50,000.

NASHVILLE, TENN.—J. E. R. Carpenter, 475 Fifth Ave., New York, N. Y., is preparing plans for the erection of a hotel in Nashville, for the Hermitage Hotel Co. Cost, about $500,000. Bids probably will be called for in September.

CANTON, OHIO.—The following bids have been received by W. S. Epperson, Arch., for the construction of the proposed new central fire and police station here, all of the bidders being of this city; Keller E. Huff, $58,571, 180 days; James Devault & Co., $68,852, 160 days; George H. Whike & Sons, $69,869, 240 days; J. Van Kirk, $71,970, 210 days; Melbourne Bros., $75,453, 200 days, and W. W. Stephens and Harry Shoof, $76,117, 270 days. None of the above bids include the plumbing, heating, ventilating, electric wiring or ornamental iron work and bars, as these contracts will be awarded separately.

CLEVELAND, OHIO.—The United States Court has given permission to B. A. Worthington, Receiver of the Wheeling & Lake Erie Ry. Co., to tear down the present frame station here to make room for a new station and general office building, which will cost over $500,000. Other improvements, costing $365,000, were authorized by the court also.

CINCINNATI, OHIO.—Garber & Woodward, Archs., Neave Bldg., Cincinnati, advise us that contract for constructing a 4-story and basement hotel for Cincinnati Union Bethel has been let to JAMES GRIFFITH & SONS CO., Reading Road and East Twelfth St., Cincinnati. The building will be 90 × 70 ft., five stories high and will cost $50,000.

Plans have been prepared by Samuel Hannaford & Sons, Archs., Hulbert Block, for a 2-story church for the Congregational Church of Christ, Rev. O. P. McMahon, Pastor. The church will cost $40,000.

PIQUA, OHIO.—Mills & Pruitt, 49½ North High St., Columbus, Ohio, have completed plans for a 2-story school building for the Board of Education, Piqua. Cost, $40,000.

YOUNGSTOWN, OHIO.—Bids are asked until Aug. 17, by C. C. & A. L. Thayer, Archs., Lawrence Savings & Trust Bldg., New Castle, Pa., for the Masonic Temple, to be erected in this city, at a cost of $125,000. The building will be seven stories high, of brick, stone and steel construction, and will cover a ground plan 64 × 153 ft. The structure will have systems of fan ventilation, plumbing and heating, two elevators, marble interior decorations, etc. The architects will prepare the plans, take bids and award all contracts.

Bids are asked by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p. m., Sept. 16, for the construction (complete) of the extension to the U. S. post-office at Youngstown.

COLUMBUS, OHIO.—D. Riebel & Sons, Archs., First National Bank Bldg., have completed plans for a 2-story, 10-room school building for the Board of Education to cost $80,000.

COSHOCTON, OHIO.—Bids will be received by the County Commissioners of Coshocton County at the County Auditor's office until 1 p. m., Aug. 18, for the metal furniture for the County Recorder's office. Plans on file with C. R. Randles, County Audr.

DETROIT, MICH.—Plans are being prepared by Malcomson & Higginbotham, Archs., Moffat Bldg., for a 2-story and basement addition to the Eastern High School for the Board of Education. William J. Lee, Secy. The addition will cost $100,000.

The general contract for constructing a 3-story bathhouse for P. Breitmeyer, Comr. of Parks and Boulevards, has been let to A. A. ALBRECHT CO., Penobscot Bldg., Detroit, at $67,719. Stratton & Baldwin, Union Trust Bldg., are Archs.

*ESCANABA, MICH.—Bids are asked until 3 p. m., Sept. 17, by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for construction, complete, of the U. S. post-office at Escanaba.

CHICAGO, ILL.—Bids will be received by the Superintendent of Public Service, County Bldg., until 1.30 p. m., Aug 24, for the erection of a tuberculosis hospital to cost $300,000.

Bids are asked by the Board of Education until Aug. 26 for erecting the proposed Bowen High School. Estimated cost, $500,000.

HILLSBORO, ILL.—Bids will be received until Aug. 27 by A. N. Banes, County Clk., for furnishing material and erecting a jail and remodeling the sheriff's residence. A. B. Frankel, Commercial Bldg., East St. Louis, Ill., is Arch.

CHICAGO, ILL.—The Chicago & Northwestern Ry. Co. has announced that its engineers and architects have completed the plans for its proposed Madison St. passenger terminal, to cost $20,000,000. The station will occupy practically four city blocks, bounded by Madison, Kinzie, Clinton and Canal Sts. E. C. Carter, Chicago, is Ch. Engr.

SUPERIOR, WIS.—The following bids were received by the Board of Education, July 28 for erecting the proposed high school: Donlin & Duplaise, Superior, $267,950; Barnett-Record Co., Superior, $265,000; G. H. Lounsbury, Duluth, Minn., $245,500; Northern Constr. Co., Milwaukee, Wis., $246,219; Dan Egan & Co., Ashland, Wis., $241,000; Schiemes & Remstad, Duluth, Minn., $258,879; McLeod & Smith, Duluth, Minn., $228,000; Lanquist & Illsley Co., Chicago, Ill., $252,857.

KENOSHA, WIS.—Bids are asked by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p. m., Sept. 10, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. post-office, Kenosha.

BRAINERD, MINN.—We are officially advised that general contract has been let to LEONARD SCHAF, of Wadina, Minn., by Thori, Albon & Fisher, Archs., Chamber of Commerce Bldg., St. Paul, Minn., for a 3-story pressed brick and cut stone bank building for the Citizens' National Bank, Brainerd. It will have plate glass fronts, steam heating, electric lighting, tiled floors, etc. Cost, $40,000. M. J. Dunn is Pres.

MINNEAPOLIS, MINN.—The contract for constructing the first floor for the Roman Catholic Pro-Cathedral, has been awarded by C. L. Masqueray, Arch., St. Paul, Minn., to PIKE & COOK, 415 South Fifth St., Minneapolis, Minn. Cost, $700,000.

MINNEAPOLIS, MINN.—C. E. Bell, Arch., Northwestern Bldg., has let general contract to J. L. ROBINSON, 205 South Seventh St., for erecting a 2-story church for the Bethlehem Presbyterian Congregation, Rev. S. B. Roberts, Pastor. Cost, $40,000.

ST. PAUL, MINN.—The contract for the superstructure of the First Methodist Episcopal Church, to be erected at Portland Ave. and Victoria St., has been let by Thori, Alban & Fisher, Archs., Chamber of Commerce, to N. P. FRANSEN, 499 West Lynnhurst Ave. Cost, $60,000.

ST. PAUL, MINN.—The School Board contemplates erecting a 2-story pressed brick and cut stone, semi-fireproof grade school building in the Tenth Ward. No architect has been selected. Cost, $45,000.

Bids are being received by John R. Mitchell, Pres. Capital National Bank, St. Paul, for construction of a residence on Summit Ave., near Hamlin Ave. Howard Shaw, 175 Dearborn St., Chicago, Ill., is Arch. It will be built of pressed brick, cut stone, marble and mosaic construction, with steam heating, electric lighting and tile roofing. Cost, $50,000.

The Sisters of St. Joseph, Mother Mary Seraphine Superior, plan to erect a 3-story pressed brick and cut stone, fireproof auditorium and music hall at Western Ave., and Iglehart St. It will have steam heating, electric lighting and modern plumbing, and will cost $50,000.

Plans are being prepared by Reed & Stem, Archs., Endicott Bldg., City, for a science hall to be built at Macalester College. It will be three stories high, of pressed brick and cut stone fireproof construction. T. M. Hodgman is Pres. of the college. Estimated cost, $60,000.

SOUTH ST. PAUL, MINN.—Bids are asked by the School Board, J. J. O'Brien, Secy., until Aug. 14 for the general construction of a 2-story school building in the First Ward, according to plans of J. J. Sheldon, Arch., South Park, Minn. Cost, $30,000.

HELENA, MONT.—Cass Gilbert, Arch., Endicott Bldg., St. Paul, Minn., is preparing plans for a 3-story, pressed brick and cut stone hospital for the Brewer Hospital Association. It will be of fireproof construction, steam heating and electric lighting. Cost, $35,000.

SHERIDAN, WYO.—Bids are asked by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p. m., Sept. 9, for construction, complete, of U. S. post-office and court-house at Sheridan.

ST. LOUIS, MO.—The Kingshighway Cumberland Presbyterian Congregation has had plans prepared by A. B. Groves, Stock Exchange Building, St. Louis, for a church, 90 × 74 ft. stone, mill construction, with steam heat and electric lighting. Cost, $100,000. MURCH BROS. CONSTRUCTION CO., 508 Odd Fellows Bldg., St. Louis, have the contract.

KANSAS CITY, MO.—C. B. Sloan, Arch., Rickseker Bldg., has prepared plans for a 2-story orphanage for the Perry Orphan Boys' Home. Estimated cost, $50,000.

FORT WORTH, TEX.—B. P. O. Elks' Lodge, No. 124, will erect a lodge building 90 × 100 ft. of brick, fireproof, five stories and basement to cost $75,000.

PORT ARTHUR, TEX.—Bids are asked by Jan van Tyen, Pres. Port Arthur Hotel Co., until noon, Aug. 22, for the erection and completion of a 3-story concrete and brick hotel. Cost, complete, $125,000. C. A. Logan is Arch., office of president.

EVERETT, WASH.—Reed & Stem, Archs., Endicott Bldg., St. Paul, Minn., have awarded the contract for the passenger station here for the Great Northern Ry. Co. to HENRY CHASE, Tacoma, Wash. Cost, $100,000.

BREMERTON, WASH.—Bids are asked until 11 a. m., Sept. 5, by R. C. Hollyday, Ch. Bureau of Yards and Docks, Navy Dept., Washington, D. C., for installing an electric elevator in the general storehouse, Building No. 59, U. S. Navy Yard, Puget Sound. Specifications are on file at the office of Engineering News, New York.

SAN FRANCISCO, CAL.—We are officially advised that the Board of Directors of the Union Trust Co. has approved designs of Clinton Day, Arch., Union Trust Bldg., for the bank building of the company, to be erected at the corner of Market, O'Farrell St. and Grant Ave. The building will be about 70 ft. high, with one story and galleries. The front of the building, which will be curved, will be 80 ft. and the depth on Grant Ave., 120 ft.

Albert Pississ, James Flood Bldg., has been selected to prepare plans for the proposed library for the Mechanics' Institute, Joseph M. Cumming, Secy., which will cost about $250,000. No bids for construction have been asked.

SAN FRANCISCO, CAL.—Bids were received as follows, at the office of James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., on Aug. 10, for the repair work to the post-office building at San Francisco, Cal.: Callaghan & Manetta, 344 Tenth St., San Francisco, $317,333, 23 months; John D. McGilvray, San Francisco, $320,000, two years; John R. Sheehan & Co., Inc., 350 Post St., San Francisco, $373,700, 14 months; Thompson-Starrett Co., New York, $325,000, 18 months; Raymond Granite Co., San Francisco, $294,800, 18 months.

SALT LAKE CITY, UTAH.—Plans for Rio Grande passenger station to be built here are being revised by Henry J. Schlacks, Arch., Borden Block, Chicago, Ill., who has charge of the work of designing the building. A number of changes are being made. The new plans call for a 2-story building, 105 × 340 ft., fireproof, of steel and concrete construction. It will be 75 ft. high. The cost will be $600,000, including the platforms and subways. The exterior will be of pressed brick and stone, with a metal roof. The interior finish will be of marble and mosaic work.

BOISE, IDAHO.—O. W. Smith contemplates erecting a 3 or 4-story reinforced concrete building, to cost from $50,000 to $75,000. No architect has been selected.

MONTREAL, QUE.—Bids are asked until 4 p. m., Aug. 14, by M. L. Z. Gauthier Savings Bank Bldg., for constructing a building for the Montreal School of High Commercial Studies, Honore Mercier, Secy.-Treas.

The Finance Committee has voted $56,550 for rebuilding fire station No. 20 and $38,000 for repairs to the City Hall. It is expected that work upon the former will be commenced at once.

WINNIPEG, MAN.—The Independent Order of Odd Fellows here has decided to erect a $100,000 building. Plans are being prepared for a 5-story brick and stone block, 66 × 150 ft. John R. Allward is interested.

*REGINA, SASK.—The following are the bids received July 20 by the High School Board for erecting the collegiate institute: WILSON & WILSON, $93,937 (awarded contract); Smith Bros. & Wilson, $96,600; May-Sharpe Co., $97,302; Snyder Bros., $97,570; Carter Bros., $97,814; W. P. Gillespie Co., $97,838; Bishop & Robertson, $106,479.

EDMONTON, ALTA.—The contract for the excavations, foundation and stone work of the proposed court-house has been awarded to R. J. MANSON, for $165,000. The heating, plumbing, plastering and carpentering contracts will be let later.

WATER SUPPLY—IRRIGATION.

(* *denotes that this work is advertised in Engineering News.*)

*SPRINGFIELD, MASS.—Bids are asked by the Board of Water Commissioners until 2 p. m., Sept. 9, for furnishing and laying about twelve miles of 42-in. pipe. E. E. Lochridge is Ch. Engr.

LAWRENCE, MASS.—The LYNCHBURG FOUNDRY CO., of New York, was awarded the contract on Aug. 3 by the Water Board for furnishing coated water pipe at $23.35 per net ton of 2,000 lbs. Other bidders were: M. J. Drummond & Co., New York, $24.10; R. D. Wood & Co., Philadelphia, Pa., $23.90; Warren Foundry Co., New York, $24; Donaldson Iron Co., Pa., $24.13; Charles F. Glavin, Boston, Mass., $24.35; the U. S. Cast Iron Pipe & Foundry Co., New York, $24.60; Builders' Iron Foundry, Providence, R. I., $25.90 with 10% discount.

*WALLINGFORD, CONN.—Bids are asked until 8 p. m., Aug. 31, by the Board of Water Commissioners for laying water mains.

NEW YORK, N. Y.—Bids are asked by John H. O'Brien, Comr. Water Supply, Gas and Electricity until 2 p. m., Aug. 19, for furnishing, delivering and laying water mains in Bathgate, Bryant, Johnson, Lafayette and Popham Aves., in Fail, 133d, 138th, 169th, 170th, 176th, 180th and 259th Sts., Borough of the Bronx; for furnishing, delivering and erecting four water tube boilers, with economizer, steam and auxiliary piping, feed water heater and high pressure drip return system and all foundations, with their appurtenances, complete, in the boiler room of the 179th St. Pumping Station, Borough of Manhattan.

NEW YORK, N. Y.—John H. O'Brien, Comr. Water Supply, Gas and Electricity, was restrained from granting a contract on Aug. 5 for furnishing and laying a 72-in. water main from Valley Stream to Amityville, L. I. The Gillespie Co., 90 West St., was the lowest bidder, at $1,879,390. The next lowest bid was that of the Cooper-Evans-Bryson Co., at $1,909,052. The restraining order was obtained through a taxpayer's action brought by Willis Holly, former Secretary to the Park Board, who alleged that the specifications prepared by the Water Department favored a monopoly, and that the granting of the contract to the lowest bidder, the T. A. Gillespie Co., would be illegal. Itemized bids are given this week under Contract Prices.

NEW YORK, N. Y.—Bids are asked until 2 p. m., Aug. 26, by John H. O'Brien, Comr. Water Supply, Gas and Electricity, for furnishing and delivering c.-i. pipe and special castings.

PITTSBURG, PA.—We are officially advised that bids were opened as follows by the city on Aug. 3 for constructing ten additional filters in O'Hara Township for the water supply: Westwater & Casey, Columbus, Ohio, $570,406; Booth & Flinn, $574,577; M. O'Herron, $598,843. The award of this work will be made to WESTWATER & CASEY, the lowest bidders, the early part of Sept. Morris Knowles is Ch. Engr., Bureau of Filtration.

*PHILADELPHIA, PA.—We are officially advised that bids were received as follows on July 29 by George R. Stearns, Dir. Pub. Wks., for Contract No. 140, extension of fire main system; Contract No. [illegible] curbing on Robbins St. and Delaware [illegible] Contract No. 146, restoring sand to th[illegible]mont, Upper and Lower Roxborough filters; Contract No. 147, s[illegible]es for the Torresdale filter plant; Con[illegible] No. 148, furnishing 48-in. c.-i. pipe an[illegible]cials; Contract No. 149, painting bu[illegible]s at the Upper and Lower Roxboroug[illegible] Belmont filters; Contract No. 150, sur[illegible] condenser for the Roxborough auxiliary [illegible]ping station; Contract No. 151, furni[illegible] 6, 8 and 10-in. c.-i. pipe and special [illegible]ngs. The bidders were: MICHAEL O'[illegible]KE, 330 G St., Philadelphia, $148,310 [illegible]rded contract); Hoffman Engineering [illegible]ntracting Co., 1116 Pennsylvania Bldg., [illegible]adelphia, $177,635; Owen J. Evers, Hee[illegible]g., Philadelphia, $153,618; M. & J. B. [illegible]ugh, 713 and 714 Arcade Bldg., Phila[illegible]a, $208,090; David Peoples, 1000 Betz [illegible]g., Philadelphia, $286,333; Filbert Pavi[illegible] Contracting Co., 904 Pennsylvania B[illegible], Philadelphia, $171,343; Robert C. Sto[illegible], Nicetown Lane and G St., Philadelphia, $[illegible]730; Millard Construction Co., 704-709 [illegible]nsylvania Bldg., Philadelphia, $170,210.

BASIC CITY, VA.—The city has voted $25,000 of bonds for water-works and other improvements. W. H. Page is Mayor.

WHEELING, W. VA.—The [illegible]ure Spring Water Co. has been incorporated with $[illegible]000 capital stock by A. S. Bel[illegible], E. L. Perkins, W. H. Curtis and others.

CHARLOTTE, N. C.—The city will extend the water mains to Elizabeth Heights, a distance of about 5,000 ft., using [illegible] piping. Estimated cost, $4,000. H. Franklins is Mayor.

ST. PETERSBURG, FLA.—The city has voted $7,000 of bonds to purchase a steam pump for the water-works plant.

FLORALA, ALA.—The city has voted $10,000 of bonds for water-works improvement.

*TOLEDO, OHIO.—Plans and specifications are on file at the office of Engineering News, New York, for the construction of sections Nos. 1, 3 and 4 of the filtered water conduit. Bids are asked until Aug. 25.

EVANSVILLE, IND.—The City Council has appropriated $225,000 for the construction of a modern filtration plant. Bids will soon be asked by the Board of Water-Works Trustees.

TEMPLETON, IOWA.—The KATZ-CRAIG CONTRACTING CO., 850 and 851 Brandies Bldg., Omaha, Neb., has been awarded the contract, at $6,048, for constructing the water-works system here. M. J. Daeges is Town Clk.

ELGIN, MINN.—The contract for furnishing a 70,000-gallon steel water tower and c.-i. water mains has been let by the city to the NATIONAL CONSTRUCTION CO., of South Bend, Ind. Loweth & Wolf, St. Paul, Minn., are Consulting Engrs.

SHAKOPEE, MINN.—Loweth & Wolf, Consulting Engrs., St. Paul, Minn., are preparing plans for a complete water-works system here. Bids will be asked about Sept. 1. C. T. Weiland is City Recdr.

SIDNEY, NEB.—The contract for the new water-works system has been let to the DES MOINES IRON & STRUCTURAL CO., at $18,750, to be completed by Dec. 1.

*PLATTE, S. DAK.—Bids are asked until Sept. 2 by the City Council for a steel water tower with steel tank of 60,000 U. S. gallons capacity and 11,424 ft. of 4-6 and 8-in. water mains laid in complete, as per plans and specifications now on file at the office of the City Auditor; at the office of J. L. Nelson, Engr., Mitchell, S. Dak., and at the office of Engineering News, Chicago, Ill. W. F. Van der Voort is City Audr.

LIMA, MONT.—Bids are asked until 10 a. m., Aug. 15, by George R. Metlen, Dillon, for furnishing material and constructing an earth dam with reinforced concrete core walls, spillway and controlling works, at what is known as the Old Lime Irrigating and Improvement Dam, near Lima, Mont. Plans and specifications may be seen at the office of G. R. Metlen, Metlen Bldg., Dillon, or Newell C. Knight, 400 Royal Insurance Bldg., Chicago, Ill.

CLARENDON, ARK.—The city contemplates installing a water and sewer system. Artesian water will be supplied. Estimated cost, $45,000.

*HOUSTON, TEX.—A. M. Lockett & Co., New Orleans, La., were the lowest bidders on July 27, at $28,583, $45,965, $35,214 and $68,730 for a 15,000,000-gallon pumping engine at the water plant. The Layne & Bowler Co., of Houston, have submitted the lowest bid for drilling two 8-in. artesian wells, one 1,200 ft. deep and the other 1,300 ft. deep, at $2[illegible] per lin. ft., $2.50 for every gallon produced daily per min. in excess of 347 gallons per minute.

GREENVILLE, TEX.—The city has voted $95,000 of bonds for the purchase of the water-works system.

BRUNNER (Houston post-office), TEX.—The Brunner Water & Light Co., which has a franchise from the Harris County Commissioners to furnish water and light, will lay two miles of water mains, construct a water tower and reservoir, drill three artesian wells and make other improvements.

FORT SAM HOUSTON, TEX.—Bids are asked by L. J. Fleming, Constructing Q. M., until 11 a. m., Sept. 3, for the construction of water, sewer and drainage systems for the new cavalry addition.

CLINTON, OKLA.—The city has voted $20,000 of bonds for the extension of the water-works system. J. L. O'Hearn is City Engr.

BEVERLY, WASH.—Three thousand acres of land in the Columbia valley at this place where the Chicago, Milwaukee and St. Paul Ry. crosses the river, will be put under irrigation by the Cohasset Irrigation Co., of Spokane, which has been incorporated with a capital stock of $200,000 by Charles Dutcher of Spokane, Thomas Joyce of Spokane, T. S. Plummer, Garfield, Wash., and O. A. Berg.

SUNNYSIDE, WASH.—The contract for the construction of the Sulphur Creek waste way channel and structures near Sunnyside, for the Reclamation Service, has been awarded to the STANDARD BUILDING CO., of San Francisco, and H. K. LUCE, of Seattle, Wash., at $96,096.

SEATTLE, WASH.—T. H. Carver, Asst. City Engr., in charge of the city's system of water mains, has been directed by the Fire and Water Committee of the Council to prepare plans for a system of salt water mains for fire protection, extending from Jackson St. to Pike St. with a connecting main running through Third Ave. between these points.

SEATTLE, WASH.—Bids were received as follows on Aug. 1, by C. B. Bagley, Secy. Bd. Pub. Wks., for the construction of the new [illegible] for the city in the Cedar River Valley water supply system, No. 2: GRANT SMITH & CO., Portland, Ore., $1,172,858 (awarded contract); James Black Masonry & Construction Co., 1101 Alaska Bldg., Seattle, $1,178,712. Itemized bids will be given under Contract Prices next week.

*PORTLAND, ORE.—Bids are asked until 11 a. m., Aug. 31, by Maj. J. F. McIndoe, Corps Engrs., U. S. A., Portland, for excavation, concrete, masonry work, etc., in connection with the construction of a portion of the Dalles-Celilo canal, Columbia River, Oregon and Washington.

BRAWLEY, CAL.—The Brawley Water Co. has been incorporated with a capital of $50,000 by H. C. Oakley, D. T. Jones, George N. Turner and others.

*LOS ANGELES, CAL.—We are officially advised that bids were received as follows on July 27 by the Board of Public Works for the construction of the Jawbone Division of the Los Angeles Aqueduct, with a capacity of 400 second ft., including about 43,000 lin. ft. of lined tunnel, 60,000 lin. ft. of lined conduit and 340,000 cu. yds. of excavation: Atlantic Gulf & Pacific Co., $2,995,966; extra work + 15 %; McArthur Bros., $2,876,570; + 10%; $2,294,202; + 10%; A. Bent, $601,135 (on Section 1); + 5%; Robert Shenen, $2,357,828; + 15%; Mahoney Bros., $779,375 (on Section 1); + 15%; T. J. Moran, $4,257,558; + 15%; Engineer's estimate, $1,956,578. All the bids were rejected by the Board as excessive, and we are informed that the work may be done by "force account." William Mulholland is Ch. Engr.

*MORENCI, ARIZ.—See under Bridges.

*MORENCI, ARIZ.—Bids are asked until 9 a. m., Sept. 16, by the Morenci Water Co., C. P. Chester, Supt., for grading and laying about 25,000 ft. of 10-in. wrought steel pipe over rough country. The work will start about Oct. 1 and must be completed by Jan. 1, 1909. The contract will be let at a price per foot.

MARYSVALE, UTAH.—R. D. YOUNG & CO. have been awarded a contract for the construction of the first 20 miles of the canal incidental to the Piute reservation project, at $30,000. Higher estimates submitted were those of J. W. Hogan at $40,000 and H. T. Reynolds, at $50,000. Stillman & Co. offered to complete five miles of the work for $10,000. The reservoir is between Richfield and Marysvale, and will have cost when completed $300,000. It will provide irrigation for 20,000 acres of land. The canal will be 40 ft. wide at commencement point, gradually narrowing to 15 or 20 ft.

TORONTO, ONT.—Bids are asked until noon, Aug. 25, by Joseph Oliver, Mayor and Chn. Bd. of Control, for laying 16 and 20-in. c.-i. water mains.

VANCOUVER, B. C.—Bids are asked by W. McQueen, City Clk., until 4 p. m., Oct. 14, for the supply of c.-i. pipes, steel pipes and Ludlow water hydrants. Specifications may be seen at the City Hall.

SEWERAGE.

(* *denotes that this work is advertised in Engineering News.*)

*BOSTON MASS.—The lowest bid opened on July 31 by the Metropolitan Water and Sewerage Board, Boston, for Section 86 of the high level sewer, South Metropolitan system, Brighton, was submitted by Charles T. Jacobs Co., 107 Terrace St., Roxbury, at the following prices: 1,305 lin. ft. of earth excavation and refill, in trench, 69 × 72-in. concrete sewer, $5.75; 1,135 lin. ft. of earth excavation and refill, in trench, 72 × 48-in. sewer, $4.45; 300 cu. yds. brick masonry, Portland, in trench, $14; 3,000 cu. yds. concrete masonry, Portland, in trench, $6.70, and 300 cu. yds. road excavation in trench, $4. Total, $38,054. Other bidders were: Hugh Nawn Construction Co., 82 Savin St., $53,621; Coleman Bros., 15 Court Square, Boston, $48,360; Bruno & Petitti, 18 Tremont St., Boston, $46,050; Donovan & Phillips, 15 Beacon St., Boston, $45,338; Falvey & Kelly, 15 Rush St., Somerville, $43,427; Glenn & Broderick, 945 Old South Bldg., Boston, $43,369; Charles G. Craib Co., Cambridge, $42,710; James Driscoll & Son, Brookline, $41,823; McCarthy & Walsh, 454 Saratoga St., East Boston, $41,021; George M. Bryne Co., 79 Milk St., Boston, $40,401; Coughlan & Sheils Co., 43 Tremont St., Boston, $40,124; James H. Ferguson, 22 Parkman St., Dorchester, $39,787; Thomas J. Young Co., 411 Pemberton Bldg., Boston, $38,716.

WOONSOCKET, R. I.—The CUMBERLAND CONSTRUCTION CO., of Providence, R. I., was awarded the contract on July 31 by the Board of Sewer Commissioners for the construction of sewers in Bernon, Maple and Federal Sts. and Wood Ave., at about $4,000.

BRONXVILLE, N. Y.—FRANK CESTONE, of White Plains, N. Y., has been awarded the contract for constructing sewers in Bronxville, at $4,112. Bids were opened on Aug. 4. G. H. Rogers is Village Engr., Tuckahoe.

GATES, N. Y.—Bids are asked until Aug. 13 by M. J. Magin, Town Clk., 510 Ellwanger & Barry Bldg., Rochester, N. Y., for constructing a brick sewer in Jay St. about 2,700 ft. long and from 3 to 5 ft. in diameter. Estimated cost, $30,000. W. R. Storey is Engr., 510 Ellwanger & Barry Bldg., Rochester.

BROOKLYN, N. Y.—Bids were received on Aug. 5 by Bird S. Coler, Boro. Pres., for constructing sewers in Scott Ave., from Newtown Creek, north of Metropolitan Ave., to St. Nicholas Ave., etc., Section 2. The Engineer's preliminary estimate of total cost for the completed work is to be taken as the 100% basis for bidding, proposals stating a single percentage of such 100% cost, such as 95%, 100% or 105%, for which all material and work called for in the contract and the invitation to bidders is to be furnished to the city. Such percentage, as bid, apply to all unit items specified in the Engineer's preliminary estimate, to an amount necessary to complete the work described in the contract. The bidders were: James Kelly, Brooklyn, N. Y., 87%; Rogers & Haggerty, 298 Gold St., Brooklyn, 94½%; Pease Brothers, Flushing, L. I., N. Y., 98.89%; J. H. Gray Co., Fuller Bldg., New York, 79.75%; Henry Newman, Scott Ave., Brooklyn, N. Y., 83%; Long Island Contracting & Supply Co., Long Island City, L. I., N. Y., 92.07%; John J. Creem Co., 688 Green Ave., Brooklyn, 86.99%.

YONKERS, N. Y.—Bids are asked until 8 p. m., Aug. 17, by the Board of Contract and Supply for the construction of a sewer in Forman St., between Woodland Ave. and Orchard St. James D. McIntyre is Secy. Bd.

*SENECA FALLS, N. Y.—Bids are asked until 4 p. m., Aug. 27, by John M. Guion, Clk. Municipal Bd., for the construction of a septic tank and appurtenances.

*NEW BRUNSWICK, N. J.—Bids are asked until 8 p. m., Aug. 31, by John S. Kemp, Street Comr., for laying about 2,000 ft. of 15-in. sewer pipe, and 3,000 ft. of 10-in. sewer pipe.

ELIZABETH, N. J.—All bids opened by the City Council for constructing an intercepting sewer and lateral sewers connected therewith were rejected on Aug. 5. W. J. Luyster, Jr., is City Surv.

KINGSLAND (Rutherford post-office), N. J.—Union Township has decided to co-operate in the construction of the proposed Passaic Valley trunk sewer.

READING, PA.—CHILES & WHITMAN have been awarded the contract for constructing an additional unit at the sewage disposal plant on Fritz's Island, at $49,105. Bids were opened on July 23 by the Board of Public Works.

EXETER, PA.—The following bids were opened on July 30 by the Borough Council for constructing sewers in Main St.: McConville & Fitzpatrick, Pittston, $21,911; D. M. Rosser, Kingston, Pa., $22,648; Pittston Construction Co., $23,527; James Munley, $19,720; Standard Construction Co., Wilkes-Barre, Pa., $20,320, Edward Healey, $19,807.

PITTSBURG, PA.—Bids are asked until 10 a. m., Aug. 17, by the City Controller for the construction of a sewer in Quebec St. (North Side) with branch sewers. Alexander B. Shepherd is Acting Dir. Pub. Wks.

READING, PA.—The Board of Public Works on Aug. 6 awarded the contract to CHILES & WHITMAN for the construction of a new unit at the disposal plant at $41,900. The unit will cost $37,000. The additional boiler and enlargement of the pumping station at Sixth St. will cost $3,700, and the maintenance of the road to the unit, $1,200. Elmer H. Beard is City Engr.

*WASHINGTON, D. C.—Bids are asked until noon, Sept. 14, by the Commissioners of the District of Columbia for furnishing two vertical compound engines at the sewerage pumping station.

BASIC CITY, VA.—The city has voted 25,000 of bonds for sewer, water-works and paving. W. H. Page is Mayor.

GRAYMONT (Birmingham post-office), ALA.—The city has voted $10,000 of bonds for the construction of sanitary sewers. W. A. Lester, Mayor.

NEWTON MISS.—The contract for the construction of the sewerage system here has been awarded to SULLIVAN & LONG, of Canton, Miss., at $3,836. Bids were opened on July 30. Xavier A. Kramer is Engr., Magnolia, Miss.

MIDDLETOWN, OHIO.—Bids are asked by John Kunz, Clk. Bd. Pub. Service, until noon, Aug. 18, for the construction of pipe sewers in certain streets.

STEUBENVILLE, OHIO.—Contracts for the construction of sewers were awarded by the Board of Public Service on Aug. 3 as follows: Sewers in portions of Adams and State Sts. and in Pleasant Heights, to J. H. VANMETER & CO., at $7,718, $3,033 and $6,259, respectively.

HAMILTON, OHIO.—Bids are asked until noon, Aug. 18, by the Board of Public Service for constructing a sanitary sewer in Franklin St. Christian Pabst is Secy. Bd.

SALEM, OHIO.—Bids are asked by the Board of Public Service until noon, Aug. 20, for the construction of a sewer in Sugar Tree Alley. George Holmes is Clk. Bd.

FRAZERSVILLE, OHIO.—Bids are asked by the Village Council until noon, Aug. 31, for the construction of a drainage sewer. A. R. Mendenhall is Village Clk.

CLEVELAND, OHIO.—The lowest bid submitted on Aug. 4, to the Board of Public Service for the construction of the portion of the intercepting sewer in Lakeside Ave. from East 40th St. to Marquette St. was that of Thomas W. Nicholson at $124,320. This bid is $50,000 lower than the estimate of the engineer.

CLEVELAND, OHIO.—BEERS & DOOLITTLE, Cleveland, Ohio, have been awarded the contract for constructing a sewer, at $28,241. The firm claim an error in figures submitted in which $7.09 per ft. was used instead of $9.09, making a difference of $2,620. They were compelled to take the work or forfeit their check for $4,000.

BOONEVILLE, IND.—Roetzel & Chipman are the lowest bidders for the construction of the South sewer, at $47,474 for concrete and $47,474 for brick.

LANSING, MICH.—THOMAS FISHER has been awarded the contract at $3,868, for constructing a sewer in Case St. and Drury Lane. Bids were opened on July 27.

JANESVILLE, WIS.—The PEOPLE'S CONSTRUCTION CO., Davenport, Iowa, was awarded the contract on July 31 by the city for work on the main sewer outlet, bulkhead, siphon, etc., to be of plain concrete construction, at $45,948.

SIOUX CITY, IOWA.—Bids are asked by the Sewer Committee, T. W. Bayne, Chn., until Aug. 18, for the construction of the Morningside sewer system, to consist of about six miles of 8, 10 and 12-in. pipe sewers.

DES MOINES, IOWA.—A contract has been let to the J. W. TURNER IMPROVEMENT CO. by the Gilmar Park Co. for the construction of 2,000 ft. of new sewer.

FORT LEAVENWORTH, KAN.—Bids are asked until 11 a. m., Aug. 27, by Capt. William D. Davis, Q. M., U. S. A., for the construction of storm water and sub-soil drains from buildings, Nos. 41, 42, 56 and 244.

FARGO, N. DAK.—Bids are asked until 5 p. m., Aug. 24, by N. C. Morgan, City Audr., for the construction of a 12-in. lateral sewer in a portion of Tenth St.

LA MOURE, N. DAK.—GILBERT W. HAGGART, Fargo, N. Dak., has been awarded the contract at $34,985, for the construction of a sewer system here.

ABERDEEN, S. DAK.—The following bids were received on July 27 for the construction of the East Side sewer system: James Kennedy, Fargo, N. Dak., $28,311; Cook Construction Co., Des Moines, Iowa, $32,869; Green & Sons Co., Chicago, Ill., $33,347; E. T. Webster, St. Cloud, Minn., $32,826; Pastoret & Lunz, Duluth, Minn., $32,932; William Frazer, Rochester, Minn., $34,396; J. J. Dunnegan, Shenandoah, Iowa, 33,381; O'Neill & Preston, St. Paul, Minn., $33,585; Jones & Roderick, Canton, Iowa, $32,647; Fambust & Sons, Sioux Falls, S. Dak., $33,816; L. W. Kelley, Aberdeen, $33,199; Tanner Bros., Webster, S. Dak., $33,727; Dewey & Sheldon, Aberdeen, $23,598; N. N. Irwin, Shenandoah, Iowa, $28,534. D. C. Washburn is City Engr.

ANACONDA, MONT.—THOMAS KELLY, Anaconda, has been awarded the contract at $4,702, for constructing two sewers here.

BOZEMAN, MONT.—Bids are asked until Aug. 20 for the construction of a portion of public sewer No. 2.

STUTTGART, ARK.—The city is considering the construction of a sanitary sewer system.

CLARENDON, ARK.—The city contemplates the construction of a sewer and water system. Estimated cost, about $45,000.

HOUSTON, TEX.—H. H. Yorty & Co. of Houston, have submitted the lowest bid for the construction of a brick sewer with vitrified invert, concrete or reinforced concrete, area same as 11-ft. circular sewer, 1,300 ft. long, at $32 per lin. ft. for brick, $26.25 for reinforced concrete and $29 for concrete. Engineer's estimate, $40,000.

SAN ANTONIO, TEX.—The city has voted $45,000 of bonds for sewer construction in Improvement District No. 7, Prospect Park.

GARBAGE DISPOSAL.

(* *denotes that this work is advertised in Engineering News.*)

RANKIN, PA.—The contract was awarded on Aug. 5 by the Council to the DE CARY CO., at $10,900, for the construction of a garbage furnace here.

AKRON, OHIO.—The Board of Health is considering the construction of a garbage disposal plant.

VINCENNES, IND.—Bids are asked until Aug. 21 by the Board of Public Works for the disposal of all dead animals, garbage and night soil, within the city limits for a period of ten years. C. L. V. Tucker is Clk. Bd.

STREETS AND ROADS.

(* *denotes that this work is advertised in Engineering News.*)

HARTFORD, CONN.—Bids are asked by the Board of Contract and Supply until 11 a. m., Aug. 17, for furnishing and laying about 550 cu. yds. of concrete base, with about 3,150 sq. yds. of sheet asphalt and 3,460 sq. yds. of granite block on American Row, Central Row and State St. The Street Railway Co. will also lay in connection with this work 970 sq. yds. of asphalt and 2,700 sq. yds. of granite block. James P. Berry is Secy. Bd.

The contract for the construction of the macadam road on Connecticut Boulevard, from Morgan St. to State St., has been awarded to R. B. DAVIS, of this city.

The contract for the construction of three sections of graded road, aggregating 5,770 lin. ft. in the town of Cornwall has been awarded to TRUMBULL & FABBRI, Litchfield, Conn., at $8,367. Other bidders were: Joseph Mascetti, Torrington, Conn., $10,940; B. D. Pierce, Jr., Co., Bridgeport, Conn., $11,500. The contract calls for five 15-in. and two 24-in. tile pipe culverts.

NEW YORK, N. Y.—Contracts have been awarded as follows by George Cromwell, Pres. Boro. of Richmond, for regulating and repaving: For regulating and repaving with vitrified brick on a concrete foundation the gutters of Lafayette, Sharp and Maple Aves. and Elm St. and Townsend Ave., to WILLIAM J. QUINLAN, Port Richmond, S. I., N. Y., at $15,623; regulating and repaving with bituminous concrete on a concrete foundation, New York Ave., Fingerboard Road and Grant St.; also on present macadam foundation, Washington, Swan and Second Sts. and Lafayette Ave., to include 2,520 sq. yds. bituminous concrete pavement, maintenance of which the railroad company is responsible; 21,088 sq. yds. bituminous concrete pavement with 5-yr. maintenance; 2,149 cu. yds. concrete foundation; 12,260 lin. ft. of 16-in. bluestone curb; 184 cu. yds. concrete girder for railroad tracks; 9,620 sq. ft. of old sidewalk, relaid; 11,931 sq. yds. old foundation, prepared, to JOHN E. DONOVAN, of Port Richmond, at $60,528; regulating and repaving with bituminous concrete on present foundation Henderson Ave., Broadway and Grove St., to include 20,768 sq. yds. bituminous concrete pavement, with 5-yr. maintenance; 565 cu. yds. concrete foundation; 10,050 lin. ft. of 16-in. bluestone curb; 75 cu. yds. of reinforced concrete; 3,600 sq. ft. of old sidewalk, relaid; 20,768 sq. yds. old foundation, prepared, etc., to UVALDE ASPHALT PAVING CO., 1 Broadway, New York, at $52,615; regulating and repaving with vitrified brick on a concrete foundation, gutters of Prospect, Britton and South Sts. and Van Pelt Ave., etc., to WILLIAM J. QUINLAN, at Port Richmond, at $17,507; regulating and repaving with vitrified brick on concrete foundation, the gutters of Seventh, Sixth, Fifth, Third, Second and First Aves., to BONACCI & VINCELLI, 672 DeGraw St., Brooklyn, at $19,732; regulating and repaving with vitrified brick on concrete foundation, the gutters of Grant, Clinton and Elizabeth Sts., etc., to same, at $18,423. List of bidders noted last week.

NEW YORK, N. Y.—Bids are asked by Louis F. Haffen, Pres. Boro. of The Bronx, until 11 a. m., Aug. 25, for regulating, grading and paving various streets in the Borough of the Bronx.

NEW YORK, N. Y.—Bids were received as follows on Aug. 10 by Allen N. Spooner, Comr. of Docks, for furnishing all the labor and materials required for repairing asphalt pavement on North and East Rivers, together with all work incidental thereto: (a) Class 1-A; (b) Class 2-A; (c) 1-B; (d) 2-B: Sicilian Asphalt Paving Co., 41 Park Row, New York, (a) $1.95, (b) $1.90, (c) $2.07, (d) $1.85; Continental Asphalt Paving Co., 42 Broadway, New York, (a) $2.15, (b) $2.15, (c) $2, (d) $2; Barber Asphalt Paving Co., 114 Liberty St., New York, (a) $2.03, (b) $2.03, (c) $1.89, (d) $1.89; Uvalde Asphalt Paving Co., 1 Broadway, New York, (a) $2.02, (b) $1.98, (c) $1.90, (d) $1.80.

*BAYONNE, N. J.—Bids are asked until 8 p.m., Aug. 18, by the City Council for the construction of a pavement on Broadway from First St. to the Morris Canal bridge. F. W. Dalrymple is City Engr.

*PORT CHESTER, N. Y.—We are officially advised that WARREN BROS. CO., 93 Federal St., Boston Mass., were awarded contracts on Aug. 10 for paving South Main St. with bitulithic on a concrete foundation, Willet Ave. with same, at $42,663 and $21,524, respectively.

F. E. MURRAY secured the contract for paving Highland St. and Locust Ave. with brick on a concrete foundation, at $17,584.

WHITE PLAINS, N. Y.—Bids are asked until 8 p. m., Aug. 17, by Peter Paulding, Village Clk., for paving improvements as follows: 7,000 sq. yds. of brick pavement, 8,000 sq. yds. of macadam pavement, 4,000 lin. ft. of vitrified tile drains and appurtenances, 18,000 lin. ft. of blue stone curbing, 18,000 lin. ft. of blue stone sidewalks, 23,000 lin. ft. of brick gutter. James F. Goerke is Village Engr., 714 Realty Bldg.

NEWARK, N. Y.—The Village Board has awarded the contract to A. A. BENNETT, 184 Jones St., Rochester, N. Y., for brick paving in South Main St., from Miller to Union Sts.

SONYEA, N. Y.—The contract for constructing the public highway across the Craig Colony estate has been awarded to McCARTHY & SIMERSON, Mt. Morris, N. Y., at $10,917. William P. Spratling is Medical Supt., Craig Colony for Epileptics.

LYONS, N. Y.—The Board of Aldermen has awarded the contract to WHITMORE, RAUBER & VICINUS, 279 South Ave., Rochester, N. Y., for grading and macadamizing Catherine St.

FORT EDWARD, N. Y.—Bids are asked by the Board of Trustees until 8 p. m., Aug. 31, for paving and grading portions of Broadway and East St. with brick, sheet asphalt, asphalt block, or other paving material. Bids for paving material other than brick, sheet asphalt, or asphalt block, must be accompanied with complete specifications for the work. Bids for all kinds of paving material are invited.

YONKERS, N. Y.—Bids were received as follows on Aug. 3 by the Board of Contract and Supply for regulating and grading the following streets: Morningside Ave., CHARLTON & WESTON, $7,645 (awarded contract); Thomas Grady, $8,750; Kearns & Hart, $8,900; McDonald & Murray, $9,524; Anthony Fisher, $9,729; Francesco Cianfaglioni, $9,978. Van Sice Ave., M. J. CALLAHAN, $7,300 (awarded contract); Kearns & Hart, $7,400; Thomas Grady, $7,400; Charlton & Weston, $8,000; Lupinacci & Ciangullo, $8,200; McDonald & Murray, $8,750; Nicholas Mangini, $8,899; Francesco Cianfaglioni, $9,430; Anthony Fisher, $9,432; Kelly & Hannifin, $9,840. Cliff St., McDONALD & MURRAY, $8,975 (awarded contract); M. J. Callahan, $9,391; Charlton & Weston, $9,445; O'Rourke Bros., $9,997; Thomas Grady, $10,500; Francesco Cianfaglioni, $10,588; Kelly & Hannifin, $11,890. Spruce St., KEARNS & HART, $5,900 (awarded contract); Charlton & Weston, $7,195; McDonald & Murray, $7,200; M. J. Callahan, $7,300; Francesco Cianfaglioni, $7,500; Kelly & Hannifin, $8,500; Dennis V. Murphy, $9,446. James D. McIntyre is Secy, Bd.

YONKERS, N. Y.—Bids are asked until 8 p. m., Aug. 17, by the Board of Contract and Supply, for curbing and guttering Sterling Ave., from Wakefield Ave. to McLean Ave.; for regulating, grading and otherwise improving McLean Ave., from the west line of Tibbits Ave. to the south line of Lawton St.; of Walnut St., from Elm St. to the south line of Maple St.; of Stone St., from McLean Ave. to Old Lawrence St.

HACKENSACK, N. J.—The B. M. SHANLEY CO., 26 Exchange Place, Jersey City, N. J., has been awarded the contract, at $148,700, for macadamizing the Paterson plank road from the Carlstadt Depot to the Hackensack River.

*JAMESBURG, N. J.—Bids are asked until 10 a. m., Sept. 2, by the Board of Trustees of the State Home for Boys for constructing a macadam road in the grounds of the home. Peter Forman is Engr., Englishtown, N. J.

PITTSBURG, PA.—Bids are asked until Aug. 14 by the County Controller, for the following road work: Leechburg extension, 1.8 miles; State road, 5.9 miles; Evergreen, one mile; Little Pine Creek extension, 2.6 miles; Three Degree road, 7.25 miles; Saltsburg extension, two miles; Noblestown extension, 1.1 miles; Windgap road, 1.4 miles. G. T. Barnsley is County Road Engr.

OAKMONT, PA.—Bids are asked until 7.30 p. m., Aug. 17, by the Borough Council for improving Tenth St., between E and H Sts. Douglass & McKnight are Boro. Engrs.

ERIE, PA.—The contract for paving State St., from 18th to 26th Sts., has been awarded to MAYER BROS. on a bid on Bermudez asphalt and concrete base, at $1.59 a yd. F. J. Eichenlaub offered to put in brick and concrete base, at $1.55 a yd., but asphalt was preferred.

WINDBER, PA.—J. E. FRANCIS & CO., of Punxsutawney, Pa., have been awarded the contract for paving macadamizing 4,396 lin. ft. of state road, starting at the borough line. The contract price is $14,178. About 3,044 lin. ft. will be paved with fire brick, and the remainder will be macadamized.

BALTIMORE, MD.—FISHER, RILEY & CORRAZA have been awarded the contract at $20,273, for improving Falls Road from Rockland to Cockeys Tavern.

NORFOLK, VA.—The Norfolk & Suburban Turnpike Co., Arthur W. Depue, Pres., will improve three roads with crushed rock.

RICHMOND, VA.—The state has appropriated $250,000 for the proposed improvement of county roads; P. St. J. Wilson is State Highway Comr.

BASIC CITY, VA.—The city has voted $25,000 of bonds for paving and other municipal improvements. W. H. Page is Mayor.

LYNCHBURG, VA.—The city has awarded the contract to A. J. MILLER & SON, of Lynchburg, for excavating, grading and laying about 1,500 sq. yds. of concrete sidewalks at $1.06 for concrete work and 30 cts. for excavating.

*GREENVILLE, N. C.—Bids are asked until noon, Aug. 18, by the town for the construction of 4,000 sq. yds. of granolithic sidewalk. H. W. Whedbee is Mayor.

MADISON, N. C.—The city has awarded the contract to C. M. THOMAS & CO., Winston-Salem, N. C., for laying about 5,000 yds. of concrete sidewalk, and to ORDWAY & SONS, Winston-Salem, N. C., for paving streets and laying curbing.

*DUBLIN, GA.—Bids are asked by the Mayor and Board of Councilmen until 8 p. m., Sept. 3, for about 17,200 sq. yds. of street paving (vitrified brick, wood block or bitulithic will be considered) with necessary granite curb as specified. Plans and specifications may be seen at the office of the City Clerk and specifications will be mailed upon application to the engineers. H. S. Jandon & Goss, Savannah, Ga., are Engrs.

FORT BARANCAS, FLA.—Bids are asked until Aug. 24 by Capt. D. W. Hand, Constructing Q. M., U. S. A., for the construction and repair of macadam wagon roads.

MEMPHIS, TENN.—The following contracts for street paving have been awarded by the city: Florida St., M. LARKIN, Memphis, $27,250; Illinois Ave., ROACH & MANIGAN, Memphis, $4,083; Central Ave., same, $4,409. J. H. Weatherford is City Engr.

OAKLEY (Cincinnati post-office), OHIO.—Bids are asked until noon, Aug. 14, by Oscar Kosche, Village Clk., for grading, macadamizing and graveling on Taylor Ave. and for constructing cement combined curb and gutter. Christopher Stichnath is Village Engr., 905 Commercial Tribune Bldg., Cincinnati, Ohio.

ZANESVILLE, OHIO.—Bids are asked until noon, Aug. 17, by the Board of Public Service for paving and curbing Putnam Ave., from Arthur St. to Cleveland St. J. T. Hahn is Clk. Bd.

CLEVELAND, OHIO.—Bids are asked until 11 a. m., Aug. 26, by the County Commissioners for improving Center road, Warrensville Township. William F. Black is Clk. Bd.

CINCINNATI, OHIO.—Bids are asked until noon, Aug. 28, by the Board of County Commissioners for the improvement of a portion of Duck Creek road. Fred Dreihs is Clk. Bd.

YOUNGSTOWN, OHIO.—MARTIN FLEMING has been awarded the contract at $13,702 for paving West Woodland Ave. with brick.

CRAWFORDSVILLE, IND.—Commissioners of Montgomery County will soon ask for bids for the construction of a gravel road in Walnut Township known as the Jones road.

COLUMBUS, IND.—Commissioners of Bartholomew County have awarded a contract to DIEKY & MARR for the construction of the Bonnell gravel road. Bids will soon be asked for the construction of the Dodd road in Hawcreek Township.

MUNCIE, IND.—Bids are asked by the Commissioners of Delaware County until Sept. 9 for the construction of three gravel roads in Perry Township, two gravel roads in Niles Township, three gravel roads in Center Township, two gravel roads in Washington Township, and one gravel road in Harrison Township. Separate bids for each road required. Joseph E. Davis is County Audr.

TERRE HAUTE, IND.—Bids are asked by the Board of County Commissioners until Sept. 5 for the construction of a stone macadamized road in Vigo County known as the McClintock road. N. G. Wallace is County Audr.

LIBERTY, IND.—Bids are asked by the Commissioners of Union County for the construction of a gravel road in Union Township until 2 p. m., Sept. 7. Clinton Gardner is County Audr.

WILLIAMSPORT, IND.—Bids are asked by the Commissioners of Warren County until 3 p. m., Aug. 29, for the construction of about 12,000 ft. of gravel road in Kent Township. R. L. Winks is County Audr.

DANVILLE, IND.—Bids are asked by the Commissioners of Hendricks County until 10 a. m., Sept. 7, for the construction of 10,968 ft. of gravel road in Washington Township. W. H. Nichols is County Audr.

VINCENNES, IND.—Bids are asked by John T. Scott, Audr. Knox County, until 2 p. m., Sept. 8, for the construction of 4,972 ft. of gravel road in Vincennes Township; 104,602 ft. of gravel road in Decker Township, and 5,065 ft. in Washington Township.

ROCK ISLAND, ILL.—The city has had plans prepared for 15 blocks of asphalt paving. W. Treichler is City Engr.

AURORA, ILL.—The following bids were opened by the Board of Public Improvement on July 28 for paving Spruce St.: Heinman & Co., $24,981; J. H. Salfisber & Co., $24,573; McCarthy Improvement Co., of Davenport, Iowa, $24,515.

CASEY, ILL.—The following are the bids opened on July 28 by the city for paving with brick: (a) Main st., (b) Washington St., (c) Jasper Ave.: Foulkes-Forbes Co., Terre Haute, Ind., (a) $11,049, (b) $16,252. (c) $30,549; A. J. Parish, (a) $12,108, (b) $18,125, (c) $33,028; F. C. Meredith, (a) $11,616, (b) $17,325, (c) $33,028; Keegan Bros., (a) 11,085, (b) $16,759, (c) $31,082; George A. Peter, (a) $11,488, (b) $17,063, (c) $31,734; A. W. Eisenmayer, (a) $11,066, (b) $17,722, (c) $33,007.

SHEBOYGAN, WIS. — Contracts were awarded on July 18 by the city to JOHN BRAUN for paving 30,010 sq. yds. of granite macadam, three inches thick, on a limestone foundation, nine inches thick, at 96 cts. per sq. yd., the cost of excavation being included; also 32,050 sq. yds. of brick on a 6-in. concrete foundation, Portland cement, 1:3:5, at $1.85 per sq. yd., excavation included.

The contract was awarded to EDWARD WONSER for 10,680 sq. yds. granite macadam, three inches thick, on a limestone foundation nine inches thick, at $1,015, excavation included. The totals of the bids were: John Braun, for brick paving, $6,012; for macadam, $28,810; Edward Wonser, macadam,, $10,840.

Contracts for curbing were awarded as follows: JOHN BRAUN, 14,240 lin. ft. combined curb and gutter, 52 cts.; EDWARD WONSER, 5,040 lin. ft. of same, 52 cts. C. U. Boley is City Engr.

BURLINGTON, IOWA.—The YOUNG & BUESCHER CO. has secured the contract for paving Ninth St. at about $16,000.

NEODESHA, KAN.—The contract for constructing brick pavement on 16 blocks and alleys has been awarded by the city to JOHN HYATT, Sedalia, Mo., at $42,000. Bids were opened on July 23. J. J. Carroll is City Clk.

ST. JOSEPH, MO.—The PHOENIX BRICK & CONSTRUCTION CO. has been awarded the contract at $1.44 per sq. yd. for paving Seventh St. with brick; and G. O. SKILBRED at $1.44½ per sq. yd. for the paving alley between Messanie and Locust Sts. with brick.

MEXICO, MO.—Bids are asked by the Mayor until 7.30 p. m., Aug. 17, for the construction before Jan. 1, 1909, of 25,103.2 sq. yds. of brick pavement. Specifications may be obtained from L. L. Winans, City Engr.

SAN ANTONIO, TEX.—The city has accepted new specifications prepared by the City Engineer for paving Houston St. Bids are asked until Aug. 20 on both vitrified brick and asphalt, the city furnishing material for foundation.

SEATTLE, WASH.—The Board of Public Works on July 25 awarded the contract for the machinery of the municipal asphalt plant to HETHERINGTON & BERNER, at $9,745. There were three other bids for the work, all of which were within $100 of the successful bidders. C. J. Moore, Asst. City Engr., has charge of the plans for the city asphalt plant, and will shortly recommend a site to the board where it will be placed. The appropriation for the municipal plant was $60,000, of which $30,000 has been appropriated for machinery to be installed in the rock quarry at Deception Pass. The rock to be obtained from the quarry is a necessary part of the material to be used in paving the city's streets. R. H. Thomson is City Engr.

SEATTLE, WASH.—The County Commissioners on July 28 let the contract for macadamizing three miles of road on the extension of Greenwood Ave. north from the city limits to STIMSON & KERN, at $21,000. There were no other bidders.

The contract for graveling Park Ave., North Renton, from the Issaquah road to the Northern Pacific railway spur, was let to C. F. PETERSON at 64 cts. per cu. yd. Other bidders were: C. R. Campbell, 67½ cts.; N. Davis, 75 cts.

TACOMA, WASH.—Seven bids were received on July 27 by H. J. McGregor, Comr. Pub. Wks,, for paving South G St., between Sixth Ave. and South 27th St. The estimate of City Engineer F. L. Davis for the G. St. work was $120,210 for asphalt and $140,404 for brick. D. A. Williams was the lowest bidder, at $102,000 for asphalt, reducing the estimate of the city engineer $18,000, and N. A. Jones was the lowest bidder on brick, at $121,000. Neither bid was accepted, as the commissioner desires to ascertain which pavement the property owners prefer. Other bidders were: Coast Contracting Co., asphalt, $115,000; Barber Asphalt Paving Co., asphalt, $107,185; Lister Construction Co., asphalt, $111,450, brick $132,474; N. A. Jones, asphalt, $107,110. D. A. Williams will probably get the contract.

LOS ANGELES, CAL.—The Board of Public Works has awarded the contract for street work on Lookout Drive and Yale to H. C. WITERS at $2.60 per lin. ft.; for grading and graveling; 33 cts. per lin. ft. for cement curb; 17 cts. per sq. ft. for cobble-paved gutter; 20 cts. per sq. ft. for cement gutter and 11 cts. per sq. ft. for sidewalk.

SAN DIEGO, CAL.—Bids are asked by the City Clerk until 7.30 p. m., Aug. 17, for constructing sidewalks and curbing on Grand Ave., in Pacific Beach, between Lamont St. and Broadway.

NIAGARA FALLS, ONT.—The Queen Victoria Niagara Falls Park Commission has awarded the contract for the first section of the boulevard between Niagara Falls and Fort Erie along the Niagara River to the QUEENSTOWN QUARRY CO. The length of the first section is about 1¼ miles and the contract price $10.522.

SHELBURNE, ONT.—Contract for the construction of cement sidewalks have been awarded to the ROYAL ARTIFICIAL STONE CO., Guelph, Ont., as follows: Sidewalks, 10 cts. per sq. ft.; crossing, 12½ cts.; extra filling, 40 cts. per cu. yd.: castings, 4 cts. per lb.

ATHENS, ONT.—The contract for cement walks here has been let to PRUNER & CO., Morrisburg, Ont., at 15¾ cts. per sq. ft.

MANUFACTURING PLANTS.

(** denotes that this work is advertised in Engineering News.*)

NEW BEDFORD, MASS.—The Dartmouth Mfg. Co. has filed plans with the Inspector of Buildings and an application for permission to erect a 1-story brick building of brick and concrete construction for manufacturing purposes. It will be utilized as additional quarters for the picker mill. The building will be 137 × 63 ft., and the single story will be 16 ft. high. The roof will be flat and of tar and slag. The company's engineer prepared the plans and is supervising construction.

HOLYOKE, MASS.—CASPER RANGER, 10 Bond St., has secured the contract to erect for the William Skinner Mfg. Co. a 4-story, 60 × 320 ft. mill adjoining the Dwight St. Mill. Estimated cost, $110,000.

LAWRENCE, MASS.—The management of the Pacific Mills has had plans prepared for an addition to the worsted mills at Lawrence. The proposed building will be 200 × 142 ft., four stories high and of brick construction.

BRIDGEPORT, CONN..—The New York, New Haven & Hartford R. R. Co. has awarded to C. W. BLAKESLEE & SONS, of New Haven, the contract for erection of trolley car barns in this city on the site north and east of the railroad station. The barns will cost $250,000. Work will begin immediately, and the contract calls for the completion of the barns by Jan. 1. Two concrete structures will be erected, and they will be utilized for housing purposes, for shops, for offices and for quarters for the motormen and conductors.

NEW YORK, N. Y.—We are advised by the TURNER CONSTRUCTION CO., 11 Broadway, that it has been awarded the contract for constructing the reinforced-concrete floor in the car barn of the Third Ave. R. R. Co., at 65th St. and Third Ave. The floor will be 324 × 202 ft. This work consists of a heavy reinforced-concrete slab on steel I-beams. Work will be undertaken at once. Cost, $25,000.

BUFFALO, N. Y.—The Jacob Dold Packing Co., 745 William St., will build a 4-story tank-house of brick and concrete at its plant at William St. and Fillmore Ave. The building will be fireproof and will cost $30,000.

Hornung & Wolf, 165 Adam St., have filed plans for a 2-story brick factory building to be erected at 163 Adams St., Buffalo, which will be operated as a tin can factory. The factory will be running about Nov. 15.

NIAGARA FALLS, N. Y.—The Carter-Crume Co., manufacturers of duplicating and triplicating salesbooks, registers, etc., has prepared plans and will receive bids this month for an addition to its factory on Highland Ave., to cost approximately $40,000.

ROCHESTER, N. Y.—E. Kirstein & Sons, 204 Court St., manufacturers of optical goods, will erect a 6-story factory building of brick and steel, 68 × 100 ft., at Andrews and Franklin Sts., and have awarded general contract for same to A. FREDERICK & SONS, 106 Mill St. Leon Stern, Chamber of Commerce Bldg., is Arch.

BINGHAMTON, N. Y.—The Binghamton Glass Co. will build a 1-story brick addition to its factory. Contract for same has been awarded to MITCHELL & WHITE.

PULASKI, N. Y.—The Ontario Iron Works will erect a 2-story brick addition to plant at this town. The addition, which will be used as a machine shop, will be 54 × 150 ft.

NORTH TONAWANDA, N. Y.—The plant of the American District Steam Co., recently destroyed by fire, is to be rebuilt, and Charles R. Bishop, Secy. and Gen. Mgr. of the company, whose general offices are located at Lockport, N. Y., is having plans prepared for two brick and steel buildings to replace the buildings burned.

LANCASTER, N. Y.—The American Malleable Co. will build a 1-story brick addition 100 × 200 ft., to its foundry. John R. Robinson, Mgr., will have charge of the work.

NEWBURGH, N. Y.—Joseph Chadwick's Sons, Lake and Dixon Sts., are having plans prepared for an addition to their bleachery building.

UTICA, N. Y.—At a meeting of the Utica-Willowvale Bleaching Co. stockholders, the proposition to increase the capital stock of the corporation from $250,000 to $375.000 was approved. Improvements will be made at the bleachery at Willowvale.

ALBANY, N. Y.—The Alabama Marble Co. of New York has been incorporated with the Secretary of State with a capital of $3,000,000 to quarry marble stone and building materials. The directors are Henry Evans, G. Trowbridge Hollister, George D. MacKay, Eugene Mayer, Jr., Henry K. Pomroy of New York, John Kerr Branch of Richmond, Va., John Stephen Sewell of Gannts Quarry, Ala.

SHARON, PA.—John B. Hewitt, of Sterling, Ill., is interested in the construction of a plant for manufacturing hinges, locks and novelties. Estimated cost, $80,000.

DAUBERVILLE, PA.—It is stated that Titus J. Siedel, of Reading, Pa., will erect a hosiery mill here.

McKEESPORT, PA.—On Aug. 1 the Peters Packing Co., 926 Mary St., let the contract for an addition to its present plant in Mary St. to BREICK BROS., and excavation work has been started. It is expected to have the plant completed by March 1, when the capacity will be more than doubled. As soon as the new addition is ready the company expects to kill 300 cattle and 1,000 hogs each week.

BALTIMORE, MD.—The stockholders of the National Hydraulic Stone Co., at their annual meeting in the office of the company, in the Builders' Exchange Bldg., selected the following directors for the ensuing year: Daniel A. Leonard, Victor G. Bloede, Charles Ingram, James [illegible] Lindsay, Charles J. Hull and Osborne [illegible] Yellott. Plans were submitted for a new plant to be situated on the line of the Western Maryland R. R., at Walbrook, a suburb, where the company owns two blocks of land between Walbrook and Clifton Aves., and between the railroad and Fifth St. The erection of the new plant will begin shortly. The company manufactures stone for building and other purposes. It is planned, as soon as the trolley shipments warrant it, to lay a street car track from North Ave. to the bed of Braddish Ave. into the center of the lot, to avoid rehandling. The length of this line would be less than 350 ft. from North Ave.

CHARLOTTE, N. C.—We are officially advised that the Jewell Cotton Mills, Charlotte, N. C., recently organized with a capital stock of $250,000, is planning to build its proposed plant. The management intends to build a structure with a capacity of 12,000 spindles, but will install only half that number to begin with. Contracts will be let about Oct. 1. The equipment will be arranged for the production of 60s and 100s 2-ply combed yarns for mercerizing. The company's officers are: W. W. Hagood, Pres.; W. A. Watson, Vice-Pres.; T. J. Lillard, Secy.-Treas.; Paul Chatham and H. C. Henderson, Dirs.

The Carson Brick Co. will rebuild the plant recently destroyed by fire at a loss of $75,000. The new plant will have a capacity of 50,000 daily. L. E. Carson is Engr. and Arch.-in-Charge.

SHELBY, N. C.—At the annual meeting of the stockholders of the Shelby Cotton Mills it was decided to enlarge the plant by building an addition and installing 2,500 spinning and 6,500 producing spindles.

GIRARD, GA.—Chattahoochee Chemical & Mining Co., T. C. S. Howard, Pres., will rebuild plant recently destroyed by fire at a loss of $10,000.

ATLANTA, GA.—We are officially advised that the Southern Wood Preserving Co., Peters Bldg., Atlanta, will establish a plant to manufacture creosoted wooden paving blocks. The equipment to include one 50-ft. 6½-in. creosoting cylinder, working pressure capacity 175 lbs.; two storage creosote tanks, 20,000 gallons each; a 60-HP. tube boiler; two pumps; 200 ft. iron track and 10 timber trucks. R. H. White is Pres.; S. E. Finley is Vice-Pres. and Treas.

JACKSONVILLE, FLA.—The C. B. Gay Co., incorporated with $50,000 capital stock, will erect a building, 117 × 330 ft., of reinforced concrete to point eight ft. above ground level, surmounted by a single story frame structure. The building will have a cellar and subcellar. A concrete tank sunk four feet below ground floor will be built. Gravity process of refining will be used. Later a charcoal clarifying process will be installed. C. B. Gay is Pres.; G. H. White, Vice-Pres.; J. R. Werner, Secy.-Treas.

WYLAM, ALA.—The Harbison-Walker Refactories Co., Farmers' Bank Bldg., Pittsburg, Pa., has secured a site here and intends to erect a fire brick plant at a cost of $250,000.

NEW ORLEANS, LA.—The International Car Co., lately incorporated with $350,000 capital, will plan construction of buildings and prepare specifications for machinery for building and repairing cars, locomotives, etc., at once. The equipment is to include motor-driven machinery for wood and iron working, boilers, engines, dynamos, electric motors, etc. Several miles of yard trackage will be required. C. A. Ralston, of Ralston & Le Baron, Chicago, Ill., Pres.; A. T. Le Baron, of same firm, Vice-Pres. and Gen. Mgr.; J. C. Flett, of New York, Secy.; A. Wagatha, of New Orleans, La., is Treas.

CHATTANOOGA, TENN.—The Southern Sockery, Chattanooga, has been incorporated with a capital stock of $5,000 to take over and continue the knit hosiery enterprise heretofore conducted by E. E. Hogue, who will be president of the new company. This company now has its goods manufactured by contract but contemplates establishing a knitting mill of its own. Paul Bogel, R. L. Groome, D. B. Hogue and H. T. Clenny are also interested.

COLUMBUS, OHIO.—Bids are asked until noon, Sept. 1, by the Board of Trustees of the Columbus State Hospital, Columbus, for alterations and improvements to the laundry building at the Columbus State Hospital. Dr. George Stockton is Secy. Bd.

ST. MARYS, OHIO.—J. G. Vrydaugh, Arch., 705 Ohio St., Terre Haute, Ind., has let general contract to WILLIAM BRODBECK, St. Marys, for alterations to 2-story factory building for the Auglaize Box Board Co., St. Marys, at $15,000.

TIFFIN, OHIO.—Plans are being prepared for remodeling the plant of the National Machinery Co. It will be 100 × 450 ft.

ATHENS, OHIO.—Frank L. Packard, Arch., New Hayden Bldg., Columbus, has let general contract to CHARLES P. KIRCHER, Athens, for constructing 2-story laundry building for the Athens State Hospital, Athens. Estimated cost, $30,000.

CINCINNATI, OHIO.—The Crane & Breed Mfg. Co., of West Eighth St., is reported to be arranging for an addition to the plant. Temporary plans are under consideration, and it is reported that the scheme of improvements provides for a general overhauling of the entire plant. All the work will not be done immediately. It is the intention to let contracts shortly for only a portion of the improvements.

DAYTON, OHIO.—The Wolf Creek Soap Co., lately incorporated, will establish a plant on Wolf Creek Pike, about a mile west of Dayton. A cement building will be occupied after it is enlarged and improved. A glycerin plant will be embodied. William S[illegible]ler is Pres. and Treas. William Schaud[illegible], Jr., is Supt.

CLEVELAND, OHIO.—It is reported that Corrigan, McKinney & Co., Perry-Payne Bldg., will erect two iron furnaces having a capacity to produce 200,000 tons of pig iron yearly, and ore docks along the upper river, to cost in all about $2,500,000.

Announcement has been made by the Otis Steel Co., 3131 Lakeside Ave., N. E., that a mill for the manufacture of 152-in. boiler plate will be added to its plant here at once. The proposed factory will cost about $600,000, and will give employment to 1,000 more workmen.

NORTH VERNON, IND.—The Cooperative Glass Co.'s plant, recently destroyed by fire, will be rebuilt. Estimated cost of new building, $20,000.

INDIANAPOLIS, IND.—The Polk Sanitary Milk Co. has purchased 2½ acres of land lying between 15th, 16th, Lewis and Yandes Sts., and intends to erect a dairy. The plant will face 15th St. The proposed dairy will cost about $80,000. Samuel O. Dugan is Vice-Pres. and Gen. Mgr. of the company.

JACKSON, MICH.—It is stated that the Wolcott & Wood Mfg. Co. has increased its capital $25,000 for the purpose of erecting a machine shop.

MONROE, MICH.—MAURER BROS., Monroe, have secured the contract for the erection of a woodworking plant for the Weis Mfg. Co. The main building will be 60 × 196 ft., two stories and basement. There will be dry kilns and a power-house. Cost, $25,000.

RIVER ROUGE, MICH.—F. T. Barcroft, Ferguson Bldg., Detroit, Mich., has prepared plans for a 3-story stone crushing plant, at River Rouge, for the Dunbar Stone Co., Detroit. It will cost $70,000.

DETROIT, MICH.—We are officially advised that the general contract has been let to B. M. ZADECK & CO., 135 Adams St., Chicago, for constructing a factory building for the Ford Motor Co. The building will cost $250,000. Albert Kahn, Union Trust Bldg., Detroit, is Arch.

CHICAGO, ILL.—It is reported that the Eli Pfaelzer Packing Co. will erect a beef packing plant at 37th and Morgan Sts., to cost $75,000. An addition is planned to the plant of the Independence Packing Co., at 41st and Halsted Sts., to cost about $50,000.

Jenney, Mundie & Jensen, Archs., New York Life Bldg., are preparing plans for a manufacturing plant for Louis F. Nonnast, furniture manufacturer, 254 North Green St. Cost, $200,000.

ANTIGO, WIS.—The Frost Veneer & Seating Co., Fred Calhoun, Mgr., 115 Fifth Ave., Antigo, will rebuild the factory recently destroyed by fire.

MILWAUKEE, WIS.—The Slocum Straw Works Co. has retained C. L. Lesser, Arch., 331 Grove St., to prepare plans for a 2-story and basement factory, 150 × 278 ft., at National, Ninth and Tenth Aves. Cost, $65,000. Albert Slocum, 635 Murray Ave., is Pres.

DOLAND, S. DAK.—Arrangements have been completed for erecting a 20,000-bushel grain elevator at this town. The elevator will be erected for Thomas Cartland, of Yale, Beadle County. Work will be commenced at once so the elevator can be completed in time for this season's crop. The elevator will be conducted under the direction of Mr. Cartland.

OMAHA, NEB.—Plans have been prepared by Lynch & Cornelius, Commercial Block, St. Joseph, Mo., for a brick, iron and steel factory and warehouse, 160 × 275 ft., for the Howard Stove Mfg. Co. The structure will cost $25,000.

ST. LOUIS, MO.—The St. Louis Independent Packing Co., which will expend $250,000 to build a cold-storage warehouse and 60 cattle pens, has purchased a site 600 × 200 ft.

KANSAS CITY, MO.—The cooperage shop of the Schwartzschild & Sulzberger packing plant, which was burned recently, will be rebuilt at a cost of $50,000.

The Prior Brass Mfg. Co. will build a plant 65 × 330 ft. in Stark's Blue River addition, east of Kansas City, for manufacturing plumbing and railroad supplies.

MALVERN, ARK.—J. A. McMahon, of the Nashville Woolen Mills, at Nashville, Ark., is planning to establish a mill to be located at Malvern, Ark. The Malvern Board of Trade is negotiating with Mr. McMahon.

SAN ANGELO, TEX.—The McFadden Compress Co., Brownwood, Tex., will erect a $50,000 compress at San Angelo.

EUGENE, ORE.—John Hunzicker, Arch., is drawing plans for a big factory to be built by E. J. McClanahan on his lot at the east end of Tenth St., near the mill race. It will be 40 × 60 ft., and will be a 2-story frame structure. It is Mr. Clanahan's purpose to install an outfit of woodworking machines and he will commence the manufacture of incubators, brooders, beehives, screen doors and windows, step ladders, etc. The machinery will be run by electric power.

PORTLAND, ORE.—C. W. Nibley, of Salt Lake City, Utah, Pres. of the Union Cement Co., Devils Slide, Utah, is at head of a combination which will build a cement plant near Portland, with an output of 1,000 bbls. a day. The plant will cover 15 acres. Site has been chosen on the Willamette River. The local directors of the company are Chas. E. Ladd, T. B. Wilcox, L. Allen Lewis and Tom Richardson. The plans call for immediate constructions of buildings on site chosen and for installation of machinery. Company is capitalized at $1,200,000.

PHOENIX, ARIZ.—Bids will be received about Sept. 15 for the construction of a grain elevator for the Phoenix Flour Mills Co., to cost about $50,000. The building will be of reinforced concrete. L. G. Knipe is Structural Engr.

FERNIE, B. C.—The Fort Steel Brewing Co.'s plant lately destroyed by fire, will be rebuilt at once. Estimated cost, $150,000.

MISCELLANEOUS CONTRACTS.

(denotes that this work is advertised in Engineering News.)*

U. S. RECLAMATION SERVICE.—Items regarding irrigation, canal projects, etc., will be found under Water-Supply—Irrigation.

DITCH.—Rochester, Ind.—Bids are asked by Wm. K. Stevanson, Const. Comr., until Aug. 15, for construction of Ditch No. 9058.

WALL.—Tama, Iowa.—Bids are asked by P. P. Schrock, Mayor, until noon, Aug. 17 for building a stone or concrete wall along Mud Creek.

RIPRAP.—Wilmington, N. C.—Bids will be received until Aug. 31 by Capt. Earl I. Brown, Corps Engrs., U. S. A., Wilmington, for 8,000 tons riprap stone.

DRAIN.—Paris, Ill.—Bids are asked by the Drainage Commissioners of Edgar County, until 11 a. m., Aug. 21, for constructing tile drain. Walter Mallonee, Town Clk.

FIREBOAT, FIRE PUMPS.—Boston, Mass.—Bids are asked by Samuel D. Parker, Fire Comr., until noon, Aug. 26, for building a fireboat; also for building two fire pumps for fireboat.

LEVEE.—Oroville, Cal.—LEWIS MOREING, of Stockton, Cal., has secured the contract for constructing levee along Feather River, at about $67,000. B. L. McCoy, of Oroville, is Engr.

LEVEE.—New Orleans, La.—Bids will be received until Aug. 24 by Lieut. Wildurr Willing, Corp Engrs., U. S. A., of the Mississippi River Comn, Fourth Dist., 1539 Louisiana Ave., New Orleans, for constructing about 189,500 cu. yds. new levee in the Lower Tensas and Pontchartrain Levee Districts.

DITCH.—Fort Dodge, Iowa.—Bids were received on July 30 for constructing ditch No. 47. Contract has been awarded to ANDERSON, SCHMOKER & BERKLAND, of Vincent, Iowa, at $18,990.

SUBMARINES.—Washington, D. C.—Bids are asked by T. H. Newberry, Act. Secy., Navy Dept., until noon, Nov. 2, for constructing by contract eight submarine torpedo boats (Nos. 20-27).

*CONCRETE DAM.—Cincinnati, Ohio.—Bids are asked by Col. Wm. T. Rossell, Corps Engrs., U. S. A., until 2 p. m., Sept. 10, for constructing dam of concrete, etc., at head of Browns Island, Ohio River.

DREDGING.—Mobile, Ala.—Bids for dredging in Grant's Pass, between Mobile Bay and the Mississippi Sound (about 60,000 cu. yds.), were opened at the office of Maury & Unruh, agents of owners, 110 St. Francis St., Mobile, on July 22, and the contract was awarded to the BOWERS SOUTHERN DREDGING CO., of Galveston, Tex., at $6,200.

*METAL WORK.—Wilmington, Del.—Bids are asked by the Light-House Engineer, Wilmington, until 11 a. m., Sept. 10, for erection of metal work for tower at Bellevue Range Rear Light Station, Del.

*FIRE MAIN SYSTEM.—Philadelphia, Pa.—Bids were received on July 29 by George R. Stearns, Dir. Pub. Wks., for Contract No. 140, extension of fire main system. Contract was awarded to MICHAEL O'ROURKE, 3330 G St., Philadelphia, at $148,310. List of bids received is given under Water-Works.

*DREDGING.—Philadelphia, Pa.—Bids will be received until noon Sept. 5 by Maj. Herbert Deakyne, Corps Engrs., U. S. A., Philadelphia, for dredging in Delaware River in Section 1, 3 and 5A.

DITCH.—Elk Point, S. Dak.—Contract has been let by Charles S. Harter, County Audr., to JOHN A. RUMBAUGH, Elkhart, Ind., at $30,000 for the construction of the Schon Ditch in Union County.

*IMPROVING CHANNELS.—Des Moines, Iowa.—No bids were received on July 15 by the City Council for improving the channels of the Raccoon and Des Moines Rivers. A. J. Mathis is Mayor; George D. Dobson is City Engr.

*CANAL.—Portland, Ore.—Bids will be received until 11 a. m., Aug. 31 by Maj. J. F. McIndoe, Corps Engr., U. S. A., Portland, Ore., for constructing a portion of The Dalles-Celilo Canal, Columbia River.

SEAWALL.—San Francisco, Cal.—Contract for building the government seawall between Fort Point and Fort Winfield Scott was awarded to the AMERICAN CONSTRUCTION CO., 338 Pine St., San Francisco, at $5,790.

WHARF.—Fort Adams, R. I.—Bids will be received by Capt. Willis C. Metcalf, Q. M., U. S. A., Newport, until 10 a. m., Aug. 18 for alteration and construction of an addition to wharf known as North Dock at Fort Adams.

DYKING.—Aberdeen, Wash.—Bids are asked by P. F. Clark, City Clerk, until 5 p. m., Aug. 19, for dyking estimated at 5,100 cu. yds., and filling, estimated at 1,458,200 cu. yds., of certain streets and alleys and lots in the city.

(Continued on page 62.)

CONTRACT PRICES.

INTERCEPTING SEWER.—Syracuse, N. Y.—Bids were received as follows on July 23 by the Intercepting Sewer Board for the improvement of Onondaga Creek, the improvement being part of the general plan for the intercepting sewer system. Henry C. Allen is City Engr. READ, CODDINGTON ENGINEERING CO., Niagara Falls, N. Y., $219,972 (awarded contract); W. J. Burns Co., $253,408.

	(A)	(B)
Clearing, lump sum	$2,500.00	$5,500.00
76,000 cu. yds. excavation	1.10	1.00
4,000 cu. yds. refilling	.60	.70
3,000 cu. yds. lining	.70	1.50
25 M ft. B. M. sheeting and bracing	50.00	45.00
12 M ft. B. M. sawed timber and lumber	60.00	60.00
4,200 cu. yds. concrete laid in place, Class A	7.00	8.50
9,600 cu. yds. concrete blocks, Class B	7.75	10.50
1,000 cu. yds. concrete blocks, Class C	8.75	11.50
400 cu. yds. brick masonry	15.00	12.00
500 sq. yds. pointing old masonry	.50	.50
300 sq. yds. cobblestone paving	1.50	2.00
60 cu. yds. stone filling	2.50	3.00
13,000 lbs. metal reinforcement	.06	.06
300 lin. ft. vitrified pipe, 2-in.	.40	.25
87,000 lbs. c.-i. pipe and special castings	.03	.04½
27,000 lbs. w.-i. pipe and special fittings	.07	.06½
44 stop valves, 3-in., each	8.00	9.00
32 stop valves, 6-in., each	15.00	20.00
4 stop valves, 12-in., each	40.00	50.00
4 stop valves, 8-in., each	25.00	27.50
4 stop valves, 14-in., each	60.00	60.00
250 sq. yds. repaving brick and asphalt	4.00	2.75
100 sq. yds. repaving concrete sidewalks	2.70	1.35
Total	$219,972	$253,408

STEEL PIPE LINE.—Valley Stream, N. Y.—Bids in detail were received as follows by John H. O'Brien, Comr. Water Supply, Gas and Electricity, on July 31, for furnishing, delivering and laying a 72-in. steel pipe line and appurtenances from Valley Stream, L. I., to Amityville, L. I.: (A) T. A. Gillespie, 90 West St., (7/16-in. thick); (B) T. A. Gillespie (⅝-in. thick); (C) H. B. Reed, 90 West St. (51/100-in. thick); (D) Stewart-Kerbaugh-Shanley Co., 527 Fifth Ave. (7/16 thick); (E) J. H. Holmes, 116 Nassau St., (½ to 15/32-in. thick); (F) J. J. Hart Co., 26 Beaver St. (7/16-in. thick); (G) Ryan & Parker Co., 21 Park Row (15/32-in. thick); (H) Cooper & Evans, 220 Broadway, (⅝-in. thick):

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
83,500 lin. ft. 72-in. steel pipe	$19.90	$21.75	$24.85	$23.00	$21.75	$22.90	$20.00	$20.75
360 tons cast iron pipe	30.00	30.00	32.00	30.50	27.50	29.00	31.50	26.00
75 tons cast iron special castings	70.00	70.00	80.00	75.00	55.00	65.00	76.00	55.00
80,000 lbs. c.-i. gate-valve boxes	.04	.04	.04	.04	.02	.04	.03 7/10	.02½
100 lin. ft. 48-in. c.-i. pipe	5.00	5.00	4.10	6.00	3.50	3.00	3.40	3.50
500 lin. ft 36-in. c.-i. pipe	10.00	10.00	3.95	5.00	3.00	3.00	2.95	3.25
100 lin. ft. 30-in. c.-i. pipe	3.00	3.00	3.15	4.00	2.75	3.00	2.70	3.00
300 lin. ft. 20-in. c.-i. pipe	2.50	2.50	2.00	3.00	2.00	2.00	2.10	2.50
3,000 lin. ft. 12-in. c.-i. pipe	1.25	1.25	1.55	2.00	1.00	1.50	1.62	1.00
350 lin. ft. 8-in. c.-i. pipe	1.20	1.20	1.00	1.50	.75	1.00	1.15	.75
300 lin. ft. 6-in. or smaller c.-i. pipe	1.20	1.20	.50	1.25	.50	1.00	.70	.75
2 48-in. steel branches	200.00	200.00	200.00	250.00	200.00	500.00	180.00	250.00
3 36-in. steel branches, in place	175.00	175.00	150.00	225.00	175.00	400.00	150.00	200.00
1 30-in. steel branch, in place	150.00	150.00	100.00	200.00	100.00	200.00	125.00	150.00
3 20-in. steel branches, in place	100.00	100.00	60.00	175.00	75.00	150.00	100.00	125.00
37 12-in. blow-offs, in place	75.00	75.00	35.00	100.00	40.00	90.00	50.00	100.00
25 48-in. valves	2,500.00	2,500.00	2,550.00	2,500.00	1,400.00	2,000.00	2,100.00	1,200.00
2 48-in. valves, F. D. & S.	2,000.00	2,000.00	1,950.00	2,100.00	1,350.00	2,000.00	1,825.00	1,200.00
4 36-in. valves, F. D. & S.	1,000.00	1,000.00	850.00	850.00	600.00	1,200.00	800.00	550.00
2 30-in. valves, F. D. & S.	600.00	600.00	600.00	750.00	400.00	750.00	460.00	500.00
3 20-in. valves, F. D. & S.	300.00	300.00	200.00	325.00	200.00	350.00	325.00	225.00
37 12-in. valves, F. D. & S.	100.00	100.00	70.00	100.00	50.00	110.00	58.00	75.00
8 8-in. valves, F. D. & S.	70.00	70.00	35.00	80.00	30.00	65.00	43.00	35.00
50,000 lbs. structural steel shapes	.03	.03	.05	.04½	.03	.05	.04½	.02½
400,000 lbs. steel reinforcement	.03½	.03½	.03½	.03½	.02½	.05	.03 2/10	.03
8 8-in. air valves, F. & S.	300.00	300.00	225.00	325.00	40.00	225.00	190.00	250.00
100 M. ft. lumber	25.00	25.00	60.00	40.00	30.00	40.00	40.00	30.00
3,500 yds. concrete	11.00	11.00	15.00	8.00	11.00	12.00	12.50	7.00
50 yds. masonry brick	11.00	11.00	16.50	12.00	17.00	15.00	20.00	20.00
300 yds. coping granite	22.00	22.00	40.00	25.00	21.00	22.00	18.00	12.00
100 yds. flagging, 8-in.	17.50	17.50	35.00	25.00	15.00	40.00	13.20	15.00
50,000 yds. paving	.25	.25	.45	.30	.50	.28	.65	.30
12,000 yds. earth excavation	.50	.50	1.00	1.00	1.25	.75	1.25	.75
10,000 yds. earth excavation	.40	.40	1.00	1.50	.75	.75	1.25	.50
5,000 yds. earth fill	.20	.20	.75	.50	.75	.40	.55	.50
250 yds. rock excavation	.50	.50	3.60	1.00	2.50	2.50	2.75	5.00
200 ft. cement curb	.50	.50	1.15	1.00	1.00	.50	.90	.50
50 yds. paving (brick)	2.00	2.00	.70	2.00	1.00	2.50	.75	2.00
1,000 yds. macadam	1.00	1.00	.40	.80	.40	1.25	.60	.75
2,500 yds. sidewalk	.20	.20	.30	.25	.25	.20	.22	.20
50 yds. cobble pavement	.50	.50	.50	1.00	.10	.60	.55	2.00
15,000 yds. top soil	.75	.75	1.10	2.00	1.00	1.50	1.25	1.50
300 bu. seed	5.00	5.00	10.00	10.00	5.00	8.00	8.00	12.00
100 ft. 24-in. pipe to lay	2.50	2.50	3.00	2.50	2.00	3.50	2.20	2.75
100 ft. 16-in. pipe to lay	2.50	2.50	1.95	1.75	1.00	2.50	1.80	2.50
Totals	$1,879,390	$2,033,865	$2,346,000	$2,175,510	$2,016,132	$2,152,915	$1,925,460	$1,909,052

LAYING WATER PIPE.—Manchester, Mass.—Bids were received as follows on July 23 by the city for laying three miles of water pipe—(A) John McCourt & Co., Boston, Mass.; (B) C. H. TAYLOR, Wellesley, Mass. (awarded contract); (C) P. F. Donovan, Boston; (D) the Hanscom Co., Boston; (E) Frank Williams Co., Boston; (F) A. G. Tommasello, Boston; (G) Loring N. Farnum Co., Boston; (H) A. De Marco, Boston; (I) F. Cowin & Co., Boston; (J) Burnham & Poor, Andover, Mass.; (K) Morley & Flatley, Manchester; (L) C. E. Trumbull Co., Boston; (M) D. Linehan & Son, Beverly, Mass.; (N) Bruno & Pettite, Boston. Raymond C. Allen, Manchester, is Engr.:

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)
6,600 ft. laying 16" pipe	$0.36¼	$0.70	$0.85	$0.62	$0.58	$0.70	$0.75	$0.50	$0.80	$0.80	$0.78	$0.88	$0.96	$0.70
9,100 ft. laying 14" pipe	.41	.50	.82	.62	.50	.67	.75	.70	.75	.75	.76	.98	.98	.60
150 ft. laying 6" pipe for blow-offs	.40	.30	.50	.50	.30	.30	.30	.28	.40	.50	.50	.25	.88	.30
1,[illegible] cu. yds. rock excavation above grade	2.85	4.00	1.60	2.75	3.00	3.50	3.25	3.40	2.75	3.00	4.50	4.00	4.50	4.00
[illegible] cu. yds. rock excavation below grade	4.50	4.00	1.65	4.00	5.00	4.00	4.00	.10	2.75	5.00	6.00	5.00	5.00	6.00
[illegible] cu. yds. earth excavation below grade	.75	.50	.60	.75	.40	1.00	.80	.10	.40	1.00	1.00	1.00	.70	.75
[illegible] cu. yds. concrete masonry	7.00	10.00	7.00	7.00	16.00	7.00	10.00	4.00	6.00	12.00	8.00	7.00	10.00	7.00
9,000 ft. 16' roadway	.75	.50	.50	.75	.80	.60	.60	1.00	.80	.75	.65	.50	.52½	1.25
Total	$17,713	$20,265	$20,519	$21,174	$21,233	$21,852	$22,750	$23,764	$23,812	$24,320	$25,249	$25,703	$27,431	$27,840

*SANITARY SEWER SYSTEM.—Portsmouth, Va.—Bids were received as follows by the Sewerage Committee at the office of the City Clerk on July 28 for the construction of a sanitary sewer system for the Fifth Ward. Bascom Sykes is City Engr.—(A) Atlas Construction & Engineering Co., Reading, Pa.; (B) Bryan & Co., Jacksonville, Fla. (recommended for acceptance); (C) David Peoples, Philadelphia; (D) Guild & Co., Chattanooga, Tenn.; (E) Burruss, Goodwyn & Robinson, Emporia, Va.:

	(A)	(B)	(C)	(D)	(E)
192 ft. 10″ c.-i. pipe	$3.03	$2.50	$11.00	$4.90	$2.85½
750 ft. 16″ c.-i. pipe	2.17	2.50	3.78	3.16	2.96
400 ft. 12″ c.-i. pipe	1.60	1.60	2.56	2.54	1.78
7,200 ft. 6″ c.-i. air pipe	.82	.73	.95	.62	.85
425 ft. 4″ c.-i. air pipe	.70	.54	.70	.48	.71¼
775 ft. 24″ D. S. t. c. pipe	1.67	3.50	2.70	4.00	3.00
1,410 ft. 15″ D. S. t. c. pipe	.97	2.25	1.90	2.12	2.367
1,306 ft. 12″ t. c. pipe	1.00	4.50	1.71	4.50	2.29½
2,780 ft. 10″ t. c. pipe	.80	1.29	1.60	1.35	1.362
41,358 ft. 8″ t. c. pipe	.95	.73	1.18	1.06	1.35
29,400 ft. 4″ t. c. pipe	.55	.22	.44	.30	.34½
84 manholes	34.00	40.00	30.00	55.00	99.30
1 manhole	86.00	100.00	125.00	145.00	250.17
77 flush tanks	47.50	55.00	65.00	65.00	77.54
Total	$77,302	$68,183	$93,950	$87,143	$102,887

DREDGING.—Pekin, Ill.—Bids were received on Aug. 5 by the Spring Lake Drainage Commissioners for the digging of open drains and ditches in the Spring Lake District. Contracts were awarded to F. J. TROUT and the FEDERAL CONSTRUCTION CO., Chicago. Estimated cost, $150,000.

WHARF, ETC.—Port Townsend, Wash.—Bids will be received until 2 p. m., Aug. 27 by Beekman Winthrop, Acting Secy., Treas. Dept., Washington, D. C., for constructing a wharf and storehouse at Waaddah Island, Neah Bay, Washington, for the use of the U. S. Revenue Cutter Service and the U. S. Life Saving Service.

WASTEWAY.—Sunnyside, Ore.—Bids were received as follows by the U. S. Reclamation Service on July 15 at Portland, Ore., for construction of the Sulphur Creek wasteway, Sunnyside Project: (A) H. D. Page, 1413 Washington St., Boise, Idaho; (B) Rich & Harris Construction Co., 611 Bailey Bldg., Seattle, Wash.; (C) V. P. Strange, 312 Dooley Block, Salt Lake City, Utah; (D) Standard Bldg. Co., 237 Sansome St., San Francisco, Cal., and H. K. Luce, 4014 Ninth Ave., N. E., Seattle.

	(A)*	(B)	(C)*	(D)†
Schedule No. 1.				
310,000 cu. yds. excavation	$0.35	$0.17	$0.18¾	$0.09
Schedule No. 2—				
3,500 cu. yds. excavation, Class A	1.00	2.50	.40	.60
5,000 cu. yds. excavation, Class B	3.00	3.50	.75	.70
3,000 cu. yds. backfilling	.50	.30	.30	.40
94,000 M. ft. B. M. sheet piling in place	60.00	40.00	80.00	30.00
1,600 cu. yds. concrete	17.00	10.60	10.00	10.00
105 cu. yds. riprap, Class A	7.00	5.50	7.50	8.00
1,680 cu. yds. riprap, Class B	5.00	7.50	5.25	7.50
Total	$61,975	$60,087	$39,177	$39,060
Total—Schedules 1 and 2	170,475	112,787	97,302	66,960

*Schedule 1 will be accepted separately, but No. 2 will not be accepted without No. 1.
†Bid is for total contract.

*SEA AND RETAINING WALL, ETC.—Wilmington, Del.—Bids were received on July 18 by the Light-House Engineer, Wilmington, for building a concrete sea and retaining wall and boat-house at Maurice River Range Light-Station, N. J. Arnold Naudain, Marshallton, Del., was lowest bidder, at $3,911, and his bid was recommended for acceptance.

MISCELLANEOUS CONTRACTS.

WHARF REPAIRS.—San Francisco, Cal.—Bids will be received until Aug. 18 at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for repairing Long Wharf, Naval Training Station, San Francisco, Schedule 88.

CONCRETE DAM.—Front Royal, Va.—Bids are asked by the Town Council until Aug. 18 for construction of concrete dam 260 ft. long and 10 ft. high on Shenandoah River. Specifications may be obtained from W. J. Kendrick, Recorder.

TROLLEY MATERIAL.—Boston, Mass.—Bids will be received by Lieut.-Col. Edw. Burr, Corps Engrs., U. S. A., until noon, Aug. 31, for furnishing and delivering electrical machinery, cable, rails, trolley and track material, etc.

DITCH.—Elk Point, S. Dak.—Bids were received by Charles S. Harter, County Audr., on July 9 for construction of the Schon Ditch in Union County. Contract has been awarded to JOHN A. RUMBAUGH, Elkhart, Ind., at about $30,000.

DAM.—Wausau, Wis.—The Wisconsin Valley Improvement Co. has awarded contract to W. E. ULE & CO., of Wausau, for building a stone and concrete dam on Long Lake. Total cost, $20,000. A. A. Babcock, Jr., is Engr., Wisconsin Valley Co.

DREDGING.—San Francisco, Cal.—Bids were received by the Board of State Harbor Commissioners on July 23 for dredging a portion of Channel St. Ralph Parker is Asst. State Engr. Contract was let to J. S. McANANY, of Oakland, Cal., at $27,250.

DRAINAGE.—Bay City, Tex.—The Drainage Commissioners of Matagorda County district No. 1 have let the contract for the construction of drainage system to the RIO GRANDE CONSTRUCTION CO., of Brownsville, Tex. Estimated total cost, $140,000.

*REPAIRING PIER.—Grand Rapids, Mich.—Contract has been awarded by Col. M. B. Adams, Corps Engrs., U. S. A. (bids received on July 14) for repairing South Pier at Grand Haven, Mich., to BURKE, SMITH & NELSON, of Muskegon, Mich., at $19,354. Fully noted on July 23.

WHARF.—Boston, Mass.—Bids were received on July 31 by the Harbor and Land Commissioners for building a wharf at Penikese Island. The two lowest bidders were the Cahill Construction Co., 7 Water St., Boston, at $4,490; Frank C. Taylor, New Bedford, Mass., $4,700.

SHAFT.—Eleanora, Pa.—The Rochester & Pittsburg Coal & Iron Co. has awarded to HEYL & PATTERSON, Pittsburg, Pa., the contract for constructing a new shaft at the mines here. The shaft will be 14 × 17 ft., and 152 ft. in depth. A new fan will also be erected at the top of the shaft.

TILE DRAIN.—Eldora, Iowa.—Bids will be received until Aug. 20 by R. A. -Vigars, County Audr., for constructing a tile drain in Drainage Dist. No. 5, requiring about 11,200 ft. 10, 12, 16 and 18-in. drain tile; also in Drainage Dist. No. 6, requiring about 10,050 ft. 10, 12, 14 and 16-in. drain tile.

DITCH.—Sterling, Ill.—Bids were received on July 25 by the Drainage Commissioners of Union Drainage District No. 1 of the towns of Hume and Prophetstown, Whiteside County, Ill., for the work of dredging out the main ditch of the district. Contract has been let to CARTER BROS., of Danville, Ill., at $8,045.

BULKHEAD, ETC.—Binghamton, N. Y.—Contract has been awarded to BARNETT & LEWIS, Binghamton, for the construction of concrete bulkhead and retaining wall, 11 ft. high and 67 ft. long, in rear of club property along the banks of the Susquehanna River, by the Directors of the Sunnyside Social and Athletic Club.

HEADSTONES. — Boston, Mass.—Bids for furnishing 15,000 white marble headstones were received by Maj. Thomas Cruse, U. S. A., Boston, Mass., on July 18, as follows: West Stockbridge Marble Works, West Stockbridge, Mass., $2.70 each; Manchester Marble Co., Astoria, New York City, $2.87; Blue Ridge Marble Co., Nelson, Ga., $3.10.

*DREDGING, ETC.—Bangor, Me.—Bids were received on July 31 by Lt.-Col. George A. Zinn, Corps Engrs., U. S. A., for ledge excavation and dredging in the Penobscot River at Bangor, as follows: Eastern Dredging Co., of Boston, $124,900; Johnson & Virden, of Lewes, Del., $134,000. The amount of the appropriation for this work is $130,000.

WASTEWAY.—Sunnyside, Wash. — Bids were received by the U. S. Reclamation Service, Portland, Ore., on July 15 for the construction of Sulphur Creek wasteway channel and structures near Sunnyside. Lowest bidders, the Standard Bldg. Co. (of San Francisco) and H. K. Luce (of Seattle), at $66,960. Itemized bids are given under Contract Prices.

BREAKWATER.—Westerly, R. I.—The contract for the construction of the breakwater and widening and deepening the breachway at Brightman's pond, Westerly, has been awarded to the TANK & McKINNON CONSTRUCTION CO., of Providence, by the Shellfish Commissioners. The work will be done at a specified sum per diem. The appropriation for the work is $10,000.

*DREDGING.—Boston, Mass.—One bid was received by the Board of Harbor and Land Commissioners on July 24, for dredging a channel at the entrance to Cuttyhunk Harbor, in the town of Gosnold. Estimated quantity, 18,000 cu. yds., scow measurement. Frank W. Hodgdon, Ch. Engr. It was submitted by John H. Gerrish, Boston, at 43 cts. per cu. yd. It was rejected as too high.

DITCHES, DRAINS.—Hartford, Conn.—The Board of Contract & Supply will receive proposals until 11 a. m., Aug. 17 for the construction of a system of open ditches and drains in the South Meadows, to consist of about 10,000 cu. yds. of excavation distributed over 20,000 lin. ft. of ditch, running from 2 to 6 ft. in bottom width with sides slopes 1½ to 1 ft. James P. Berry is Secy. of Bd.

FENCE.—Brooklyn, N. Y.—The TURNER CONSTRUCTION CO., 11 Broadway, New York, has been awarded a contract by the Long Island Railroad Co. for the construction of approximately 1,000 ft. of reinforced concrete fence on Sixth Ave., between Atlantic Ave. and Pacific St., Brooklyn. This fence is 3 ft. 6 ins. high, of reinforced concrete throughout. Work will be undertaken at once.

*EMBANKMENT.—Greenville, Miss.—All bids received by the Board of Mississippi Levee Commissioners on Aug. 3 for the construction of about 900,000 cu. yds. of embankment in the Mississippi Levee District have been rejected. New bids are asked until noon, Sept. 7, for construction of about 1,250,000 cu. yds. of embankment. C. H. West, Ch. Engr.; Robert Somerville is Asst. Ch. Engr.

LEVEE.—New Orleans, La.—Three bids for the construction of the Gregory levee in Plaquemines parish were received on July 14 at the office of the State Board of Engineers. The bid of Patrick H. Lyon, offering to do the work for 23.47 cts. per cu. yd., was found to be the lowest and was recommended to the Governor for acceptance. The other bids were from Gid. R. Turner and Aiken O'Reily Co.

DITCHES.—Pocahontas, Iowa.—Bids were received on July 21 at the office of J. A. Terry, County Audr., for furnishing material and constructing ditches in Drainage Improvement Districts Nos. 8, 27 and 33. Total estimated cost of tile and open ditch, $51,324. Contracts for Nos. 8 and 33 were let to R. A. ELY & CO., Marshalltown, Iowa; No. *27, to PARSONS & SMITH, Humboldt, Iowa.

DRAINAGE.—Emmetsburg, Iowa. — Bids will be received until 1 p. m., Aug. 19, by the Board of Supervisors, at Emmetsburg, for certain drainage improvements in Dist. 21, Secs. 1 to 15, inclusive; Dist. 16, Secs. 3 to 6, inclusive; Dist. 28, Secs. 1 to 11, inclusive; and Dist. 29, Secs. 1 to 17, inclusive, consisting of digging ditch and laying tile. Quantities, estimates, etc., on file at office of Engineering News, New York.

DREDGING.—Brooklyn, N. Y.—Bids were received as follows by Allen N. Spooner, Comr. Docks, on Aug. 5, for Contract No. 1148, for furnishing all the labor and materials required for dredging about 4,200,000 cu. yds. between 28th and 36th Sts., South Brooklyn: John A. Seely, 62 Cedar St., New York City, 52 cts. per cu. yd.; MORRIS & CUMMINGS DREDGING CO., 17 State St., New York, 46.8 cts. (awarded contract).

RETAINING WALL.—Cleveland, Ohio.—Director of Public Service has awarded to COOK, GRANT & FRITZ BROS., a contract for the construction of a retaining wall at the sewage purification works for $6,233. The bids for the construction of the wall ranged from the amount bid by the successful firm up to $137,380. The wide range was due to the fact that several contractors bid on tons of material instead of pounds.

*CANALS, DITCHES.—Angleton, Tex.—Bids were received on July 30 by the Board of Commissioners, Angleton Drainage District, F. Oberhelman, Chn., at the office of Masterson & Rucks, Angleton, for constructing 31 canals, drains and ditches, requiring a total excavation of approximately 653,238 cu. yds. earth. J. L. Chambers, Engr., Angleton. Lowest bidder was J. B. Arpen, of Grand Rapids, Wis., at 12.84 cts. per cu. yd.

LUMBER.—New York, N. Y.—Bids were received on July 16 by James W. Stevenson, Comr. of Bridges, for furnishing and delivering (A) yellow pine, white pine, oak and spruce lumber, to the Brooklyn bridge; also (B) same date for 400 M. ft. of spruce plank to the Brooklyn bridge. Contract for (A) was awarded to ARTHUR C. JACOBSON & SONS, Brooklyn, at $7,807; (B) D. M. RESSEGUIE, 14 Grand Ave., Brooklyn, at $9,162.

TOWN.—ACOSTA, PA. — The Somerset Coal Co., of Baltimore, Md., has awarded the contract for the construction of a new town of this name at the Jenner No. 4 and 5 Mines, in Somerset County, Pa., to the NICOLA BUILDING CO., Farmers' Bank Bldg., Pittsburg. The contract calls for the construction of a modern tipple, 25 double miners' houses, superintendent's residence, warehouses, blacksmith shops, store buildings, and supply house.

DRAINAGE.—Clarion, Iowa.—Bids were received on Aug. 3 by E. M. Callender, County Audr., for construction of Drain No. 25 in Lincoln and Blain townships. Contract was awarded to WARD BROS., Audubon, Iowa, at $6,650. Contract for Ditch No. 30 awarded to BELMOND CONCRETE CONSTRUCTION CO., Belmont, Iowa, at $8,490. All bids for Ditch No. 21 were rejected and new bids will be received in September. Geo. L. Mechem, Drainage Engr.

LEVEE.—Clarksdale, Miss.—Bids were received at the office of the Levee Board, Clarksdale, on July 28, for the following levee work: Sec. 15 (Star Landing), 112,000 cu. yds. new levee; Sec. 16H, 46,700 cu. yds. enlargement; Sec. 17H, 35,000 cu. yds. enlargement; on sections 21H and 22H, 26,200 cu. yds. enlargement. The contract for Section 15 was awarded to R. L. LEONARD, of Memphis, Tenn., at 15.5 cts. per cu. yd. The bids on the balance of the work were rejected, and contracts will be let without readvertising.

DRAINAGE.—Paragould, Ark.—Bids were received on July 15 by Lund & Hill, Engrs., Little Rock, Ark., for dredging in the Cache River Drainage Dist. No. 1 and Swan Pond Dist. No. 1, Greene County. Contract for Cache River work was let to L. V. SCHUTT, St. Louis, Mo., for 588,400 cu. yds., at 7¾ cts.; Sec. 1, Swan Pond, J. M. FUTRELL, Paragould, 5,100 yds., at 13¾ cts.; Sec. 2, Swan Pond, W. T. STEDMAN, 7,500 yds., at 12.95 cts.; Sec. 3, Swan Pond, W. S. COLEMAN & SONS, Hamlet, Ind., 402,400 yds., at 9⅝ cts.

LEVEE.—Memphis, Tenn.—Bids were received by St. George Richardson, County Engr., Memphis, on July 17, for (A) one mile of levee to be raised*through Nonconnah Creek bottom, on Pigeon Roost road, requiring 20,000 cu. yds. of earth. Also (B) for 5,000 ft. of levee to be built through Big Creek bottom, about one-half mile from Millington, Tenn., requiring about 20,000 cu. yds. of earth. Contract for (A) was let to T. D. THURMAN, at 14.75 cts per cu. yd. Contract (B) was awarded to PEARSON & SIMS, at 11.99 cts.

*STEEL GATES.—Nashville, Tenn.—Bids were received as follows by Maj. Wm., W. Harts, Corps. Engrs., U. S. A., Nashville, on July 15, for constructing and erecting steel lower gates for Hales Bar Lock, Tennessee River—(A) steel castings; (B) steel lock gates; (C) total: Baltimore Bridge Co., Baltimore, Md., (A) $78, (B) $38,890, (C) $38,968; Penn Bridge Co., Beaver Falls, Pa., (A) $89, (B) $37,339, (C) $37,428; N. D. Yant & Co., Allegheny, Pa., (A) $85, (B) $33,652, (C) $33,737; Modern Steel Structural Co., Waukesha, Wis., (A) $100, (B) $31,000, (C) $32,090.

FERRY BOATS.—New York, N. Y.—Bids were received as follows by Allen N. Spooner, Comr. Docks, on July [illegible] for furnishing all the labor and material required for furnishing and delivering miscellaneous duplicate parts for the municipal ferry boats: Newport News Boat Co., $18,400; J. W. Sullivan Co., 827 East [illegible]nth St., $16,402; Griscom-Spencer Co., [illegible] West St., $18,749; Columbia Engineering Works, Brooklyn, $23,900; James Shewan, Foot East Houston St., $15,855; John F. [illegible]sh, Jr., 137 Charlton St., $18,755; J. Edward Ogden, 147 Cedar St., $16,900.

SALE OF VESSEL.—Washington, D. C.—Bids are asked by the Revenue-Cutter Service, Treasury Dept., until 2 p. m., Aug. 17, for the purchase of the revenue cutter "Dexter." The "Dexter" is a single screw steamer of 370 tons displacement, with wooden hull; extreme length 143 ft. 6 ins., beam molded 23 ft., draft 9 ft. 6 ins. The "Dexter" is at the depot, Revenue-Cutter Service, Arundel Cove, Md., and can be seen at that place on application to Captain J. [illegible] Brown, U. S. R. C. S., who will furnish any additional information regarding it that may be desired and a list of articles of outfit that are to be sold with the vessel.

CEMENT.—Reading, Pa. — Bids were received as follows on Aug. 4 by the Board of Water Commissioners for 5,500 bbls. Portland cement for Bernhart slow sand filters: (A) brand of cement; (B) price per bbl., not including bags; (C) total: Hoff & Bro. (rejected as informal on account of conditional bid), Reading, (A) Atlas or Alpha, (B) $1.17, (C) $6,435; C. D. MILLER & SON (awarded contract), Reading, (A) Lehigh, (B) $1.19, (C) $6,545; Gring Bros., Reading, (A) Edison, (B) $1.19, (C) $6,545; Chas. L. Moll, Reading, (A) Penn Allen, (B) $1.20, (C) $6,600; Dexter Portland Cement Co., Philadelphia, (A) Dexter, (B) $1.21, (C) $6,655; Bard Hardware Co., Reading, (A) Saylor's, (B) $1.22, (C) $6,710; Charles H. Fisher, Reading, (A) Phoenix, (B) $1.24, (C) $6,820; David C. Geiger, Reading, (A) Bath or Phoenix, (B) $1.38, (C) $7,590.

TELESCOPES.—Washington, D. C.—Bids were received as follows by the Chief of Ordnance, War Dept., Washington, on July 27, for furnishing 100 observation telescopes: Queen & Co., Philadelphia, $450 each, delivery four within four months and twelve each month thereafter; The A. Leitz Co., San Francisco, Cal., total, $14,500, delivery within nine months; The Bausch & Lomb Optical Co., Rochester, N. Y., $292 each, delivery one in 60 days, 50 by Dec. 1, and balance by May 1, 1909; P. A. Geyer Co., Cleveland, Ohio, $325 each, delivery 25 in three months, balance in four months; Pratt & Whitney Co., Hartford, Conn., $387.50 each, delivery 25 in 60 days, 25 in 90 days, 25 in 120 days, and 25 in 150 days; Kueffel & Esser, Hoboken, N. J., $270 each, delivery 25 in 170 days, 75 in 120 days; Warner & Swazey, Cleveland, Ohio, $174 each, 25 in four months and 25 each succeeding month thereafter.

BARGE CANAL.—Albany, N. Y.—Bids were received on Aug. 11, by F. C. Stevens, Supt. of Pub. Wks., for Barge Canal Contract No. 31, being for the improvement of the Erie Canal at Little Falls and constructing guard gates at Rocky Rift; length, 1.01 miles; the work including the construction of Lock No. 17, with gates and anchorages, lock valves, buffer beams, etc., four guard gates, complete; substructure and superstructures for a bridge; storehouses; embankments; wash walls; dry walls, etc., the operating machinery for the lock not being included in the contract. The bids received were: Fidelity Construction Co., Majestic Bldg., Detroit, Mich., $837,988; Williams Engineering & Contracting Co., 13-21 Park Row, New York, $850,594; Casey & Murray, Rochester, N. Y., $829,770; Coast & Interior Contracting Co., Fayetteville, N. Y., $881,318; The John Pierce Co., 90 West St., New York, $864,655. The engineer's estimate is $813,800.

FLOATING DERRICK.—Bremerton, Wash.—Bids were received as follows on Aug. 8 by the Bureau of Yards and Docks, Navy Dept., specification No. 1589, for a 100-ton floating derrick having a 15-ton auxiliary hoist, at the Navy Yard, Puget Sound, Wash.: The Interstate Engineering Co., Bedford, Ohio, (Item 2) $238,796 (Item 3) $334,726. The Wellman-Seaver-Morgan Co., 7000 Central Ave., Cleveland, Ohio, (Item 1) $230,000, (Item 2) $150,900, (Item 3) $250,000, $164,000. Variety Iron & Steel Works Co., 1277 East 40th St., Cleveland, Ohio, (Item 3) $234,000, all with crane complete, $242,100, $243,800, $230,800, $244,100, (Item 3) $171,000 all without pontoon, $171,000, $171,700, $167,700, $170,000. Morgan Engineering Co., Alliance, Ohio, (Item 3) $248,185, $173,975, (deduct $10,000 if only one generator unit is desired). The Brown Hoisting Machinery Co., 4403 St. Clair Ave., N. E., Cleveland, Ohio, (Item 3), $281, 600 crane complete; $212,200 without pontoon; $240,000 crane complete; $174,400 without pontoon; $250,200 crane complete; $183,600 without pontoon.

DITCH.—Webster City, Iowa.—Contracts were awarded as follows by the Board County Supervisors, at the office of O. A. Cragwick, County Audr., on July 16 for constructing ditches: Construction of open work on Brietenkamp-Gannon district, Fremont Township. NORTHERN CONSTRUCTION CO., at 6¾ cts. per cu. yd. The tile work was also awarded this company at $5,500. The TUSCOLA CO. was awarded the construction of the Hill-Brandrup district ditch in Hamilton Township, at $20,450. This company also received the contract for hte Knickenbocker district, near Williams, at $1,700.

Bids are asked until 1 p. m., Aug. 19, by O. A. Cragwick, County Audr., for constructing Webster-Hamilton Joint Drain Nos. 54-58. The open work of said drain to consist of 99,802 cu. yds. of excavation. Open work, main line, 90,140 cu. yds., average cut 9.13 ft. Open work, Rhoades branch, 9,662 cu. yds., Average cut 8.31 ft. Bids will be received for different sizes of tile, also for material and labor complete. Bids will be received for vitrified clay tile. Bids will be received separately for furnishing tile on line ditch and for digging, laying and filling.

*LEVEE.—Vicksburg, Miss.—Bids were received as follows on July 22 (postponement from July 8) by Capt. Clarke S. Smith, Corps Engrs., U. S. A., Vicksburg, for about 511,000 cu. yds. of levee work in the Third District. Lower Yazoo levee district in Mississippi—(A) stations 450-500, above Greenville, 373 miles below Cairo, 78,000 cu. yds. enlargement; (B) stations 900-950, above Greenville, [illegible] miles below Cairo, 80,000 cu. yds. enlargement; (C) stations 950-1000, above Greenville, 381 miles below Cairo, 80,000 cu. yds. enlargement; (D) stations 1345-1375, below Greenville, 499 miles below Cairo, 31,[illegible] cu. yds. enlargement; (E) stations 1570-[illegible], below Greenville, 502 miles below Cairo, 132,000 cu. yds. enlargement. Upper Tensas levee district in Arkansas—(F) Stations 2050-2155, 468 miles below Cairo, 100,000 cu. yds. enlargement; (G) station [illegible], 451 miles below Cairo, 10,000 cu. yds. spur extension:

George K. Lacy, Arkansas City, Ark., (F) 30¼ cts.; Shields Bros. & Nystrom, Greenville, Miss., (A) 23.9 cts., (D) 47.23 cts., (F) 33.95 cts.; Roach & Stansell, Memphis, Tenn., (A) 23.7 cts., (B) 23.7 cts. (both or none), (C) 23.7 cts., (D) 42 cts., (E) 32.7 cts., (F) 30 cts.; W. S. & George H. Lowrance, Luna Landing, Ark., (D) 33½ cts., (E) 27.9 cts., (F) and (G) 27¾ cts. (both or none); R. L. Leonard, Memphis, Tenn., (C) 34 cts., (E) 34 cts., (F) 27¾ cts.; Donoven & Daley, Lake Providence, La., (F) 27.7 cts.

BARGE CANAL.—Albany, N. Y.—Frederick Skene, State Engineer and Surveyor, in his statement as to the progress on Barge Canal work gives some interesting figures as to the amount of work done during the past six months. The value of the work done up to July 1, 1908, was $1,322,910 as against $494,837 worth of work accomplished in the first six months of 1907, and as against $201,520 worth of work done during the corresponding months of 1906, thus showing that two and two-thirds as much has been accomplished thus far this year as was done during the same time in 1907, while the increase over 1906 is more than six fold. The totals given for the various years are: 1905 (eight months), $330,120; 1906, $712,806; 1907, $2,214,535; and for six months of 1908, $1,322,910, making a grand total of work done to July 1, of $4,580,371. As to excavation, a record seems to have been reached during the month of June, 1908, when 1,142,529 cu. yds. of material were removed. In comparing this total with excavation work on the Panama Canal, which work was commenced just about one year before the Barge Canal operations, the State Engineer says: "In June, 1907, there were excavated on the Panama canal 962,199 cu. yds. of material. The Barge Canal record for June, namely, 1,142,529 cu. yds., exceeds the amount by 19%. However, larger monthly totals had been attained at Panama prior to June, 1907. Comparing June's Barge Canal record with the greatest accomplishment on the Isthmus up to a year ago (1,159,486 cu. yds. in April, 1907,) it appears that the Barge Canal attainment is only 1½% less than this, the largest Panama record up to that time, or, in terms of comparison, within a corresponding length of time from the beginning of operations on each undertaking."

U. S. POSSESSIONS AND CUBA.

CABLEWAYS.—Panama.—Bids were received as follows on Aug. 7 at the office of the Isthmian Canal Commission, Washington, D. C., for the furnishing of one single and six duplex cableways: S. Flory Mfg. Co., Bangor, Pa., item 1, $45,000; item 2, $77,800; item 3, $155,600; total, $278,400; delivered, 90-120 days; erected 270 days. Lidgerwood Mfg. Co., 96 Liberty St., New York, item 1, $30,200; item 2, $113,400; item 3, $165,400; total, $309,000; delivery, 90-150 days; erected 270 days. New York Cableway & Engineering Co., 2 Rector St., New York, item 1, $29,684; item 2, $93,536; item 3, $154,580; total, $277,800; delivered, 60-120 days; erected, 150 days. Alternates: $160,880; $299,975. Balanced Cable Crane Co., 135 William St., New York, item 1, $17,331; item 3, $101,394; item 2, $59,100; total, $177,825. Alternates, $275,514; delivered, 120-240 days; erected 270 days.

LUMBER.—Panama.—Bids were received as follows on Aug. 10 at the office of the Isthmian Canal Commission, Washington, D. C., for furnishing (on Circular 456, Class 46,) a quantity of creosoted lumber and on Class 47, a quantity of piles: Atlantic Creosoting & Wood Preserving Works, Norfolk, Va., $9,421.90; 120 days; (47), $20,798.25; 120 days. Arthur Gamwell, Seattle, Wash., (46) $8,030.46; 120 days; (47), $23,912.37; 120 days. Gulfport Creosoting Co., Gulfport, Miss., (46), $8,417.46; 90 days; (47), $22,689; 90 days. Southern Creosoting Co., Slidell, La., (46), $7,854.79; 80 days; (47), $22,068.75; 80 days. Southern Sawmill Co., New Orleans, La., (46), $8,426.83; 80 days; (47), $23,854.96; 118 days. Vermilye & Power, New York, (47), $32,778; 130 days. West Pascagoula Creosoting Works, Gautier, Miss., (46), $9,258.65; 120 days; (47), $20,798.25; 120 days. W. R. Grace & Co., New York, on Douglas fir, (46), $7,463.60; 120 days; (47), $21,743.62; 120 days. Norfolk Creosoting Co., Norfolk, Va., (47), $28,361.25; 120 days.

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INDUSTRIAL NOTES.

FLETCHER & LINK, engineers, Bridgeport, Conn., announce the organization of a department of their business for the sale of contractors' supplies.

THE WYCKOFF PIPE & CREOSOTING CO., INC., announces the removal of its main offices from Stamford, Conn., to the Hudson Terminal Bldg., 50 Church St., New York City.

THE RUST BOILER CO., Pittsburg, Pa., in order to give better attention to its growing business in the East, has opened an office at 50 Church St., New York City, in charge of E. M. Rust.

THE CHESTER B. ALBREE IRON WORKS CO., Allegheny, Pa., announces that it has been awarded the contract for about 12,000 feet of railing, 6 ft. in height, for the Blackwell's Island Bridge, New York City.

THE ATLAS DRYER CO., of Cleveland, Ohio, reports the sale of one of its Atlas dryers, Hercules type, for drying nitrate of soda, to the E. I. Du Pont de Nemours Powder Co., of Wilmington, Del. The dryer is to be shipped to Pinole, Cal.

THE ZELNICKER CRAYON WORKS, of St. Louis, Mo., have appointed Harmon & Dixon, 117 Chambers St., New York, exclusive agents for their line of crayons for New York and contiguous territory. A full stock of the Zelnicker line will be carried by them.

THE LINK-BELT CO.'s weekly report of orders received by its Philadelphia plant includes a sand batch elevator, a raw fish conveyor, extension to sugar-handling machinery, a lumber conveyor, belt conveyor equipment, and coal-handling machinery at a coke plant.

THE GAS MACHINERY CO., Cleveland, Ohio, announces that Wile Producers, heretofore furnished by the Wile Power Gas Company, will hereafter be exclusively manufactured and sold by The Gas Machinery Co. J. I. Wile will be sales Manager of the Wile Producer Department.

THE HOOPESTON GAS & ELECTRIC CO., Hoopeston, Ill., recently added to its plant a 280-HP. Muenzel producer gas plant which was installed by the Minneapolis Steel & Machinery Co. This plant has now been in operation for a number of weeks and it is giving very good satisfaction.

THE NEW YORK OFFICES of Wadsworth, Howland & Co., previously at 1024 Fifth Ave., have been removed to 156 Fifth Ave. The above company is manufacturer of Bay State brick and cement coating, which is a composition adaptable as a finish on concrete, cement, brick and plaster, and which is not affected by dampness or alkali usually contained in these surfaces.

THE MINNEAPOLIS STEEL & MACHINERY Co., Minneapolis, Minn., has just started work on another 300-HP. Muenzel producer gas engine and gas producer for the Aberdeen Light & Power Co., Aberdeen, S. Dak. This company already has a 300 HP. Muenzel plant which has been in operation since spring, and they are now adding another unit to take care of the increasing load.

THE AMERICAN DISTRICT STEAM CO., of Lockport, N. Y., advises us that on Friday, the 24th ulto., it suffered the loss by fire of a portion of its Tonawanda plant, where its casing mill and foundry is located. Plans are made for rebuilding the burned portion on an enlarged scale, which is to be of fireproof construction. The company informs us that its business for the season will not be delayed on account of the fire. The loss is fully covered by insurance.

THE MESTA MACHINE CO., of Pittsburg, owing to the increased demand for their product in the central and middle West, has opened an office in Chicago at 844 Commercial National Bank Building, from which point the company's business in rolling mill machinery, gas and steam engines, condensers and machine molded gears, steel castings, etc., will be taken care of by Lane Johnson, who for some time has been connected with the Pittsburg office of the Mesta Company.

THE PARKER BOILER CO., Philadelphia, Pa., reports the recent completion of the third order from Michigan College of Mines, Houghton, Mich., calling for one 268-HP. unit. The college already has two 120-HP. units, one installed in 1901 and the other in 1904. The Parker company received an order from United Verde Copper Co., Jerome, Ariz., for two 265-HP. boilers equipped with superheaters, and an order from Belen Mining Co., Nacozari, Sonora, Mexico, for two 130 HP. units.

JOHN F. ALLEN, 370-372 Gerard Ave., New York City, reports recent sales of Allen riveting machines to the Eastern Steel Co., Pottsville, Pa.; York Bridge Co., York, Pa.; Delaware Bridge & Iron Co., Delaware, Ohio. The "Allen" riveter has proved to be especially well suited for car construction work and has many distinctive features which are not to be found in machines of other makes. These are fully explained in a recent catalog, copies of which may be obtained on application.

THE SCULLY STEEL & IRON CO., Chicago, Ill., advises us that it has absorbed the plants and business of Kelley, Maus & Co., also of Chicago. The lines now handled by the Scully Steel & Iron Co. include structural steel, plates, black and galvanized sheets, boiler tubes, rivets and bolts, bars, hoops, bands, boiler shop and railroad supplies, sheet iron workers' supplies, electrical steel, corrugated sheets, roofing and siding, iron workers' machinery and tools, wagon, carriage and blacksmithing tools and supplies, machinists' supplies, hardware, etc.

AN INITIAL SHIPMENT of water-cooled power transformers, forming part of an ultimate equipment of thirty-six transformers, aggregating 10,530 KW., for the U. S. Reclamation Service, in connection with the Salt River, Arizona, irrigation project, has recently been made by the Wagner Electric Mfg. Co. The specifications for these transformers were issued last July, and the contract was awarded to the Wagner Company under severe requirements as to insulation, operating characteristics, etc., and also under rigid stipulations as to prompt delivery. The recent shipment comprises six 350-KW. 25-cycle, 2,300-26,000-volt step-up transformers and nine 235-KW., 25-cycle, 23,100-1,100-volt step-down transformers. The design of the transformers required dealing with certain special conditions at the places of installation, among which were the limited space for handling the transformers in the power-house, and the high temperature of the cooling water, due to the hot climate of the desert region. The water is circulated through the cooling coil of each transformer by a Wagner three-phase motor-driven triplex pump.

THE INDEPENDENT PNEUMATIC TOOL CO., Chicago, Ill., informs us that during the first two weeks of July more orders were booked for the Thor pneumatic tools and appliances than during any similar period since last October. A large number of inquiries were received from railroads, foundries, boiler shops and bridge works, from which orders are expected to materialize this month. The company states that there is every indication that business in its line will greatly improve from now on, and therefore the force of workmen at the plant at Aurora, Ill., is to be increased.

THE AMERICAN STOKER CO. announces the removal of its offices from Erie, Pa., to the Park Building, Pittsburg, Pa., where all communications should be addressed. The company in reorganizing its management installed as its Chief Engineer John Van Brunt, who has had several years' experience with the stoker problem; and having made very advantageous arrangements with the Coshocton Iron Company, which company is closely allied to the steel interests, the company is prepared to execute promptly all orders for Stokers or Stoker Repair Parts both Chain Grate and American Underfeed and at the lowest market price for similar goods.

THE INDUSTRIAL INSTRUMENT CO., Waterbury, Conn., has purchased, according to reports, the plant at Foxboro, Mass., built by the Van Choate Electric Co. and recently owned and operated by the Schaeffer & Budenberg Co., of Magdeburg, Germany, manufacturer of gages, valves, &c. The Industrial Instrument Co. is headed by Bennett B. Bristol, until recently head of the Bristol Co., Waterbury, manufacturer of recording instruments, &c. This is a holding company. The plant at Foxboro will be operated by a new corporation, to be known as the Standard Gage Mfg. Co., which will manufacture gages, recording instruments, etc. Watson E. Goodyear, Naugatuck, Conn., will be President of the Standard Gage Mfg. Co.; Bennett B. Bristol, Treasurer, and Arthur F. Mundy, Syracuse, N. Y., Secretary. The two main buildings are of brick, 60 × 210 ft. each, and three stories. Between them extends a forge shop and testing room, 42 × 76 ft. The foundry is 60 × 150 ft., one story, with skylights. A carpenter shop is 30 × 42 ft., and two stories, and there is a glass furnace building, 39 × 39 ft., used by the recent owners for a brass polishing shop. The power plant contains three Wm. T. Harris Corliss engines, respectively, of 100, 250 and 150 HP., with three electric generators, and there are four 100-HP. Roberts boilers. The property includes a gas plant, with a building for the storage of oil, and one with two complete sets of gas-making apparatus, and a gasometer of large capacity. The Industrial Implement Co. has just increased its authorized capital stock from $202,500 to $2,000,000.

TRADE PUBLICATIONS.

NAUTICAL ENGINES.—American Blower Co., Detroit, Mich. Catalog 232. Paper; 7 × 9 ins.; pp. 64; illustrated.

Detailed descriptions are here given of two types of automatic, high-speed, enclosed, self-oiling engines of from 1 to 65-HP. capacity.

DEEP-WELL PUMPS.—Rumsey & Co., Seneca Falls, New York. Paper; 8 × 6 ins.; pp. 16; illustrated.

A line of single-cylinder pumps for artesian wells and another line of triplex pumps for deep open wells is described.

COUPLINGS FOR LEAD PIPE.—The Anderson Coupling Co., 556 Capitol Ave., Hartford, Conn. Paper; 8 × 5½ ins.; pp. 28; illustrated.

This pamphlet presents a line of couplings, cocks, etc., for joining lead to lead and iron to lead pipes.

POWER PRESSES.—Zeh & Hahnemann Co., Newark, N. J. Paper; 4 × 9 ins.; pp. 12; illustrated.

In this pamphlet are described power presses, drop and screw presses for a variety of uses, including wedge adjustment presses for delicate work.

CENTRIFUGAL PUMPS.—Erie Pump and Engine Co., Erie, Pa. Catalog F. Paper; 6 × 9 ins.; pp. 36; illustrated.

Centrifugal pumps, for various classes of services are described and illustrated. The pamphlet also contains a few pages on small gas and gasoline engines for marine and stationary service.

HANDLING COAL AND ORES.—The Jeffrey Mfg. Co., Columbus, O. Bulletin No. 25. Paper; 6 × 9 ins.; pp. 48; illustrated.

The range and character of the Jeffrey Co.'s installations of coal and ore handling machinery is well set forth in this booklet by means of illustrations of actual equipments in operation.

MEASURING TAPES AND RULES.—The Lufkin Rule Co., Saginaw, Mich. Paper; 6 × 9 ins.; pp. 97; illustrated.

This is a descriptive catalog and price list covering a wide variety of measuring devices. About half of the book is devoted to steel and linen tapes of different sizes and kinds for ordinary and special work. Most of them are enclosed in cases, but some are wound upon open frames. Surveyors' arrows and staves for holding the tape-frame are included. The remainder of the book is devoted to steel and wooden rules, scales and squares, graduated for a variety of uses, gage rods, yardsticks, lumber measuring rules, log calipers, etc., are among the special devices listed. Descriptions and prices are given in each case.

DEEP-WELL IMPELLER PUMPS.—Roth Mfg. Co., A. E. Tripp, Sales Agent, Indianapolis, Ind. Paper; 5 × 6½ ins.; pp. 38; illustrated.

This pump consists of a series of impellers, located at intervals along a shaft, extending down a cased well, with a series of "retarders" between the impellers.

CONCRETE REINFORCEMENT, STEEL FURNITURE AND FITTINGS.—The General Fireproofing Co., Youngstown, Ohio. Paper; 6 × 9 ins.; pp. 12; illustrated.

In the notice of this pamphlet that appeared in our issue of July 16, the address of the company was wrongly given as Columbus, O.

PRESSURE REGULATING VALVE.—The Ohio Brass Co., Mansfield, O. Paper; 6 × 8¾ ins.; pp. 15; illustrated.

The Collin pressure regulating valve is designed to reduce the boiler pressure to any pressure required for heating, cooking, drying or other service. It is also designed to maintain a uniform service pressure regardless of variation in the initial pressure.

WATER METER BOXES.—McWane Bros., 220 Broadway, New York City. Paper; 6 × 3½ ins.; pp. 12; illustrated.

A line of molds and iron covers for water-meter boxes is described. These are for use where it is desired to install the meters outside a building. The concrete bodies are to be made by the contractor who installs the boxes.

SPECIFICATIONS FOR RAILS AND SPLICE BARS.—The American Bureau of Inspection and Tests, Monadnock Block, Chicago. Paper; 3½ × 6¼ ins.; pp. 20; illustrated.

This pamphlet contains the rail specifications of the American Railway Association, and the rail and splice-bar specifications adopted by the steel manufacturers. There is also the report of the American Railway Association's committee on standard rail and wheel sections.

STEAM BOILERS.—The Hodge Boiler Works, 70 Kilby St., Boston, Mass. Paper; 9½ × 6½ ins.; illustrated.

Nearly every type of steam boiler, except the water-tube is shown in this catalog. Data, specifications and methods of construction are given for externally and internally-fired, return tubular boilers, and for locomotives and marine-types. There is some additional descriptive matter on auxiliaries, such as grate bars, pressure tanks, vulcanizers, stand pipes, etc.

BELT LACING.—The Bristol Co., Waterbury, Conn. Paper; 6 × 3½ ins.; illustrated.

Staggered point steel belt lacing is made in sizes suitable for belts of every width and thickness. It makes a flexible joint which runs smoothly even on small pulleys, avoids cutting or tearing the belt, and may be easily and quickly applied. This booklet contains directions for applying the lacings and a price list of the ten different sizes.

ROAD IMPROVEMENT.—Imperial Road Co., Times Building, New York. Paper; 5 × 6¾ ins.; pp. 15; illustrated.

This pamphlet relates to a system of road construction which it is said will solve the dust problem by giving a substitute for macadam that will be durable and generally satisfactory. Unfortunately for those of an inquiring mind, the pamphlet contains scarcely any information as to the character of the pavement. There are a few testimonials, one of which indicates that the pavement has been in use for some time in Kansas City and has given satisfaction there.

ROLLER PRESSES.—Kutztown Foundry & Machine Co., Kutztown, Pa. Stiff paper; 10 × 7 ins.; pp. 22; illustrated.

There are here described and illustrated roller presses designed especially for garbage reduction and rendering plants. The presses are of the Edgerton continuous type. The rolls are made of close-grained hard iron and the shafts of steel. The chains and perforated plates forming the filter bed are also of steel. Specially designed adjustable springs are provided to relieve any shocks that may occur, and also brakes to prevent breakage in case foreign substances get into the rolls. The presses are enclosed in order to prevent the exposure of the tankage to the air. These presses are now in use at the reduction plants which treat the garbage of the cities of New York, Philadelphia, Baltimore, Boston, Newark, Reading and Wilmington.

For other Proposal Advertisements see pages 43, 44, 45, 46, 50, of Advertisements and Construction News page 64.

SEWERS.

Cape May, N. J., August 10, 1908.

Proposals will be received by the City Council of the City of Cape May in Council assembled on Wednesday, August 26, 1908, at 8 o'clock p. m., in the Council Chamber of the City Hall of said city, for the construction of a part of its sewerage system in accordance with the plans and specifications therefor, which can be seen on file in the office of the Recorder of said city.

The work will comprise the construction of about 4,037 lineal feet of cast-iron pipe sewers and 4,275 lineal feet of vitrified pipe sewers, with the manholes, junction manholes, and house connection branches thereto appertaining.

Copies of the plans and specifications will be loaned to intending bidders by the Recorder of the City of Cape May, upon application by mail or in person, at a charge of $10.00 for the set, which will be refunded upon the return of said plans and specifications within 30 days after the letting. Any other information desired, in accordance with the said specifications, may be obtained from Stillwell H. Townsend, City Engineer, at his office in Cape May, N. J.

The proposals must be made in strict accordance with the plans and specifications and upon the proposal sheets; must be sealed and delivered to said City Council at the time and place specified and at no other time or place will any proposals be received.

Upon receipt of the proposals the same will be publicly opened and their contents announced in the presence of such of the persons bidding or their agents as may choose to be then and there present, and record of the terms and prices will be made in the minutes of said City Council.

The details, form of proposals, provisions and conditions, subject to which the proposals must be made and will be received are shown in said specifications, notice and instructions to bidders.

S. F. WARE,
President of Council.

Attest:
JNO. W. THOMPSON, Recorder.

SEWERS.

Hackensack, N. J.

Sealed proposals will be received by the Hackensack Improvement Commission at the Commission Rooms, Union Street, Hackensack, at 8 p. m., on Tuesday, September 8, 1908, for the construction of the Poplar Avenue Sewer, consisting of

1,000 feet of 24-inch pipe sewer
816 feet of 21-inch pipe sewer
345 feet of 18-inch pipe sewer
600 feet of 12-inch pipe sewer
16 manholes
13 catch basins

DRAWINGS AND SPECIFICATIONS may be seen and blank forms of proposals obtained at the office of Lemuel Lozier, Engineer, Bank Building, Main and Mercer Streets, Hackensack.

All proposals shall be made upon the blank forms furnished.

All proposals shall be accompanied by a certified check for Five Hundred ($500.00) Dollars drawn to the order of the Hackensack Improvement Commission as surety that if proposal is accepted contract will be entered into.

The Hackensack Improvement Commission reserves the right to reject any or all bids.

C. LINKROUM,
President.

E. PHILLIPS,
Clerk.

STORM SASH, VESTIBULES AND SCREENS.—Fort Wood, N. Y. H., August 11, 1908.—Sealed proposals, in triplicate, for furnishing and placing storm sash, vestibules and screens on one set captains' quarters, at this post will be received here until 10.45 a. m., September 10, 1908, and then opened. Information furnished on application. The U. S. reserves the right to reject any or all bids. Envelopes should be marked "Proposals for storm sash, etc., and be addressed to WM. W. BESSELL, Constg. Qr. Mr.

MACADAM ROAD.

Sealed proposals to construct a Macadam Road on the grounds of the State Home for Boys, Jamesburg, New Jersey, 4,100 feet long, will be received by the Board of Trustees of the State Home for Boys at their main office on said grounds, on Wednesday, September 2d, 1908, at 10 o'clock in the forenoon, and then and there publicly opened.

Specifications, plans and information relating to said construction may be seen and consulted by applying to Peter Forman, Engineer, Englishtown, N. J., or at the main office of the Board of Trustees of the State Home for Boys, Jamesburg, N. J., or at the office of the State Comr. of Public Roads, State House, Trenton, N. J.

Each bidder must accompany his proposal with a certified check for One Thousand Dollars ($1,000.00), payable to the order of the President of Trustees of said Board, as a guarantee if said work is awarded to him, he will enter into a contract and agreement with said Board for the due and faithful performance of said work, which contract and agreement must be executed, together with the bond of the successful bidder, within the term of twenty (20) days from the time of awarding the contract. Said bond shall be in the sum of at least the total estimated cost of the work, with two or more Freeholders, or a good and sufficient Surety or Trust Company as sureties; all to be first duly approved by the President of the Board of Trustees and State Commissioner of Public Roads and conditioned for the faithful performance of the work in strict conformity with the plans and specifications.

The Board of Trustees reserve the right to reject any and all bids if it shall be deemed to the best interests of the State to do so.

EDWARD SPAETH,
President Board of Trustees.

VITRIFIED AND CAST-IRON PIPE.

Sealed proposals, addressed to the Chairman of the Board of Water Commissioners for the laying of approximately 800 lineal ft. of 15" vitrified pipe, 2,520 lineal ft. of 10" cast-iron water pipe, and 4,200 lineal ft. of 8" cast-iron water pipe; the excavation of about 1,000 cubic yards of rock and about 50 cubic yards of earth, will be received up to 8 o'clock P. M. of Monday, August 31st, and publicly opened. These quantities are approximate only and will be used as a basis for comparison of bids. All bids must be made upon blank forms to be obtained from the Water Department Engineer and be accompanied by a certified check, payable to the Wallingford Water Fund, for the sum of Two Hundred and Fifty Dollars ($250.00), said check to be subject to forfeiture if the bidder fail to execute the contract should it be awarded him. Specifications and form of tender can be obtained at the office of the Water Department Engineer, Town Hall, Wallingford, Conn. The Wallingford Board of Water Commissioners reserve the right to reject any or all bids should it deem it to be for the best interest of the Borough of Wallingford to do so.

Wallingford Water Commissioners,
(Signed) S. G. BALDWIN,
Chairman

SEWER PROPOSALS.

New Brunswick, N. J., Aug. 16, 1908.

Sealed proposals will be received at Common Council Chambers in the City of New Brunswick, N. J., on Monday, Aug. 31, 1908, at 8 o'clock in the evening for the laying of approximately two thousand feet of fifteen inch sewer, and three thousand feet of ten inch sewer. Bids must distinctly state that they are for "all or for part" of said work, as the committee shall finally decide. Bids must be accompanied with a certified check on a local bank for $1,000.00, payable to the City Treasurer of New Brunswick. Plans and specifications may be seen at the office of the City Surveyor. The right is reserved to reject any or all bids. Address JOHN T. KEMP, Street Commissioner, New Brunswick, N. J.

42-INCH PIPE LINE.

STEEL, WROUGHT IRON OR CAST IRON.

Board of Water Commissioners,
43 Bridge St., Springfield, Mass.

Sealed proposals will be received by the Board of Water Commissioners of the City of Springfield, Mass., until two o'clock P. M., Wednesday, September 9, 1908, for about twelve miles of pipe as included under Little River Water Supply, Contract No. 4.

42 inch steel pipe delivered and laid complete.
42 inch wrough iron pipe delivered and laid complete.
42 inch cast iron pipe delivered.
Laying 42" cast iron pipe.

The award will be made for only one form of pipe.

Bids will also be received for 1,821 lineal feet of 54 inch steel pipe to be delivered f. o. b. cars, Westfield, Mass.

The 42 inch pipe line is to be the main supply pipe connecting the new Little River Water Supply in the town of Westfield with the Connecticut River at Springfield, Mass., and lies across the towns of Westfield, Agawan and West Springfield, Mass.

This line includes about 3,000 cubic yards rock excavation and some special work at the crossing of the Westfield River and several brook crossings.

Each bid must be accompanied by a certified check for the following sums:

42 inch wrought iron or steel pipe line complete	$10,000
Cast iron pipe and specials	5,000
Laying cast iron pipe	5,000
54 inch steel pipe	none

Bonds will be required to be executed by the party to whom the contract is awarded in the following sum:

42 inch wrought iron or steel pipe	$100,000
Cast iron pipe and specials	50,000
For laying cast iron pipe	50,000
54 inch steel pipe	none

Pamphlets containing information for bidders, forms of proposals, specifications, contracts and bonds may be obtained at the office of E. E. Lochridge, Chief Engineer, Springfield, Mass., and at the office of Hazen & Whipple, Consulting Engineers, 103 Park Ave., New York City.

The Board reserves the right to reject any or all bids or to accept any bid should they deem it for the best interests of the city so to do.

C. H. BENNETT,
E. E. STONE,
W. E. SANDERSON,
Board of Water Commissioners.
E. E. LOCHRIDGE,
Chief Engineer.
August 10, 1908.

SEALED PROPOSALS will be received at the office of the Light-House Engineer, Wilmington, Del., until 11 o'clock A. M., Sept. 10, 1908, and then opened, for the erection of metal work for tower at Bellevue Range Rear Light-Station, Del., in accordance with specifications, copies of which, with blank proposals and other information, may be had upon application to the Light-House Engineer, Wilmington, Del.

Situations Wanted

Mechanical and Electrical Engineers.

MECHANICAL ENGINEER, marine, designer and inventor; expert on steam, gas and petroleum engines; possessor of valuable improvements in gas engines; wants position where ability and experience count. Address "A. A. 7," Engineering News, New York. 7-1t

MECHANICAL ENGINEER (33), college graduate, experienced in manufacture of steam and electric cranes, hoisting machinery and railroad plant, steel and metal expert, and manufacture guns and ammunition. Address "B. A. 7," Engineering News, New York. 7-1t

Civil Engineers.

CIVIL ENGINEER (33), resident railroad survey and construction, shaft sinking, iron and brick tunnelling, experienced in structure, bridge work and concrete, cranes, steam shovel and track. Qualified A. M. I. C. E., England. Address "C. A. 7," Engineering News, New York. 7-1t

GRADUATE C. E.; now employed; work nearing completion. Offers under $40 monthly, and transportation, not considered. Address LOCK BOX 677, Bordentown, N. J. 7-1t

CONTRACTING AND CIVIL ENGINEER (35) requires engagement [illegible] reinforced concrete, sewerage, sewage disposal, buildings, railroads, construction and design. Address "G. A. 7," Engineering News, New York. 7-2t

AN ENGINEER having extended experience in location, construction and operation of railroads, the prospecting, development and operation of [illegible] mines and other industrial properties, will be disengaged after October 1st. Address "I. A. 7," Engineering News, New York. 7-3t

CIVIL ENGINEER (24), Troy Polytechnic graduate, desires position with contractor or engineering firm, with chance for promotion. Not afraid of hard work. Will go anywhere. Address "K. A. 7," Engineering News, New York. 7-2t

Bridge and Structural Engineers.

BRIDGE ENGINEER.—Long experience as chief dratsman in the bridge department of large railway. Experienced designer of buildings, draw bridges, viaducts, turntables, coal tipples, way structures, masonry, foundations, reinforced-concrete construction; also specifications, tests and reports. Address "F. A. 7," Engineering News, New York. 7-1t

Surveyors.

RODMAN, experienced, desires position; can run transit or level; can give references. Address "E. A. 7," Engineering News, New York. 7-1t

Draftsmen.

YOUNG MAN seeks position as assistant draftsman; two years in engineer's office. Address "E. A. 6," Engineering News, New York. 6-1t

TECHNICAL GRADUATE, with eight years' experience in all kinds of structural detailing and designing, would like position with firm doing general engineering work. Address "X. A. 7," Engineering News, New York. 7-2t

STRUCTURAL DRAFTSMAN, 6 years' experience; technical graduate. Address "Z. A. 7," Engineering News, New York. 7-1t

Superintendents, Misc., etc.

AN ENERGETIC, painstaking, active and capable engineer having recently finished the location and construction of about fifty miles of railroad desires position as resident engineer or in full charge of a small project. Splendid testimonials. Address "W. 7," Engineering News, New York. 7-1t

MANAGEMENT of a contract wanted by a young and active engineer who has just finished a large railroad contract. Have a good record which excellent testimonials will prove. Address "Z. 2," Engineering News, New York. 7-1t

SUPERINTENDENT OR ENGINEER, 34 years old; 14 years' experience on construction work; thorough in concrete buildings and fireproof construction; open for engagement after Aug. 15. Address "D. A. 7," Engineering News, New York. 7-1t

AMERICAN, age 29, college education, seeks opportunity to prove his ability at very moderate salary. One and a half years as mechanic in three shops. Three years as office manager; three years as salesman (mechanical lines). Good knowledge and experience in electricity, mechanical drawing, gas engines, etc. Address E. HUTTON, 70 West 50th St., New York City. 7-1t

Situations Open

SUPERINTENDENT—On sewer construction in Brooklyn and vicinity; good, competent and hustling man; answers must state experience, names of employers and salary, to receive attention. Address "L. A. 7," Engineering News, New York. 7-1t

FOR SALE

FOR SALE.

HYDRAULIC PUMP DREDGE

15" suction. Apply to W. S. BROWN, 3 West 29th St., New York. 7-1t

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FOR SALE.

A Well Established

Engineering and Surveying Practice

in town of 25,000 people in northern Illinois. Good opportunity for capable and enterprising man. Address "H. A. 7," Engineering News, New York. 7-2t